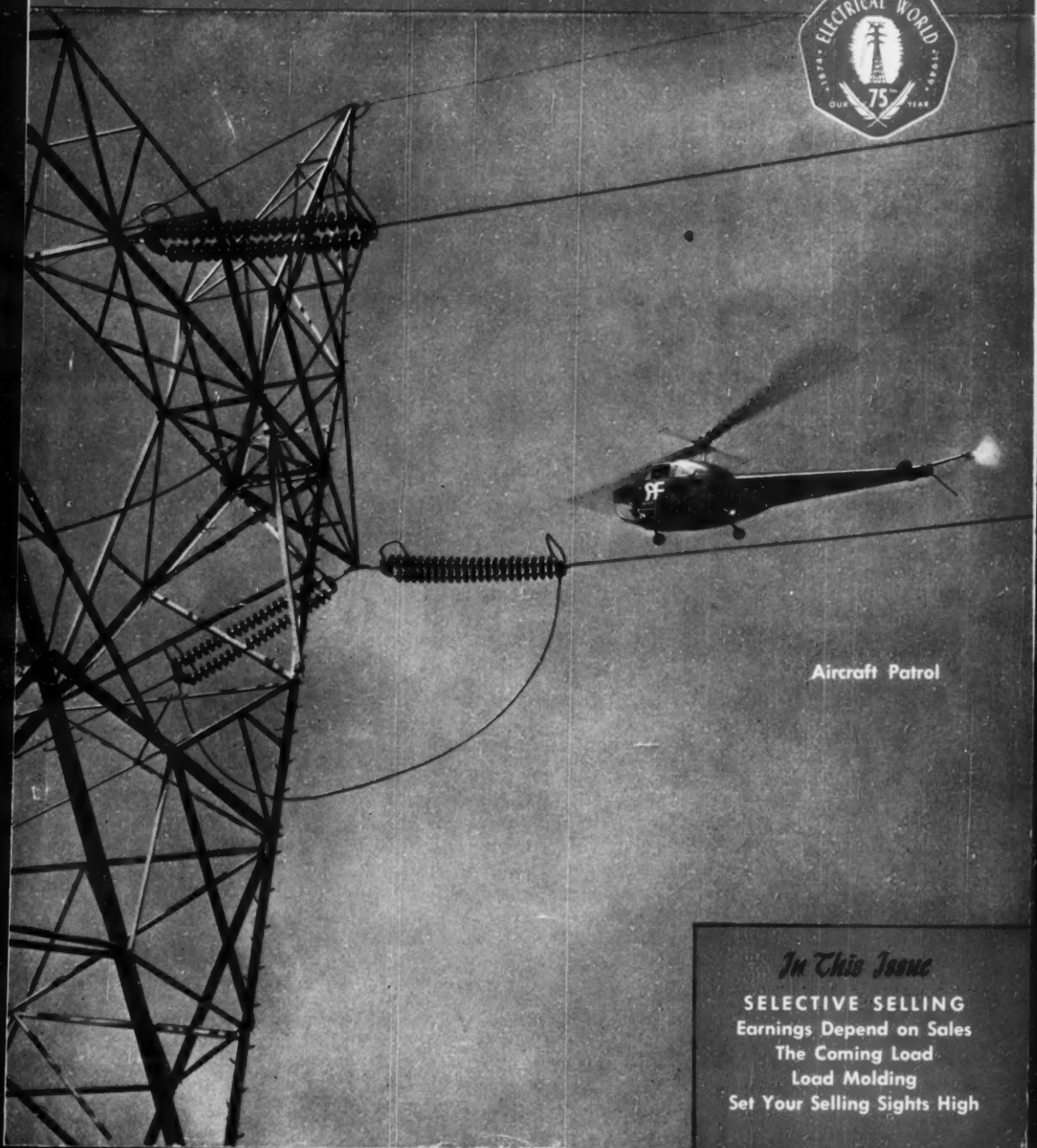
ELECTRICAL WORLD

A McGRAW-HILL PUBLICATION

MARCH 26, 1949



Aircraft Patrol

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SELECTIVE SELLING
Earnings Depend on Sales
The Coming Load
Load Molding
Set Your Selling Sights High

NEW WESTON

MODEL 901 SERIES
A-C AND D-C PORTABLES

the modern concept

in **READABILITY . . .**

in **SHIELDING!**

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ELECTRICAL WORLD

Published for 75 years for those engaged in the business of generating, transmitting, distributing or applying electric power

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COVER PICTURE—Helicopter patrol of the 287.5 kv Boulder Dam transmission lines is now routine. But when this picture was taken the helicopter shown was making the first experimental patrol over the lines.

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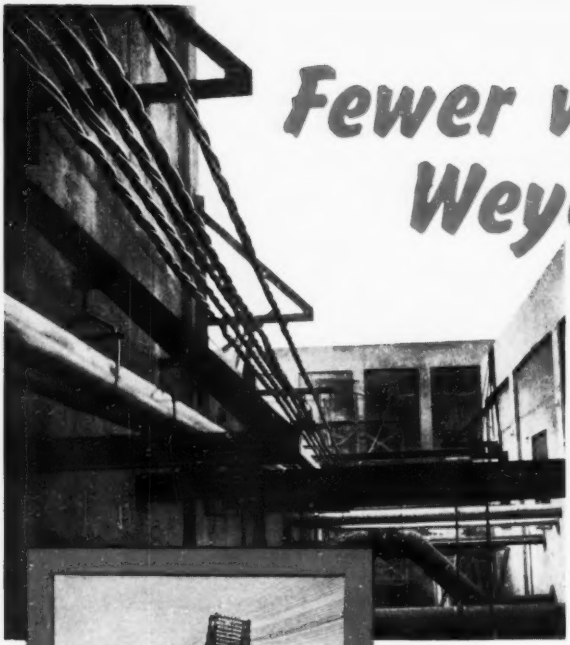
Fewer wires for Weyerhaeuser!



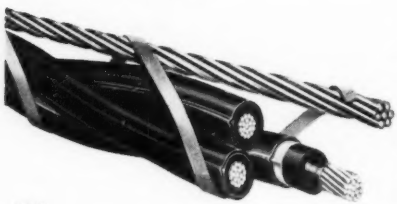
. . . space saved
. . . installation cost lowered
. . . all-weather dependability assured with

OKOLITE-OKOPRENE SELF-SUPPORTING AERIAL CABLE

Contrast the congestion shown in lower picture with the compact, simple installation of Okolite-Okoprene Self-Supporting Aerial Cable (above) at Weyerhaeuser's new pulp mill at Longview, Wash. Recently-erected generating plant is in background. Installation was made by Western Electrical Construction Co., Portland, Oregon.

At Longview, Wash., the new MgO sulphite recovery and new sulphate pulp processing plants of the Weyerhaeuser Timber Company typify the advantages of self-supporting cable in industry for the transmission and distribution of power. Here, Okolite-Okoprene Self-Supporting Aerial Cable serves between a new generating plant and an old one. It contrasts strikingly with the congestion of open wiring.

With Okolite-Okoprene Self-Supporting Cable, *self-evident space economy* is matched by installation economy as it requires no separate stringing. Further savings result from the long life of this storm-safe all-weather cable assembly.



7305

Another feature of Okolite-Okoprene Self-Supporting Cable that makes it valuable in industrial plants is this fact: *safe as well as easy* handling is assured. The cable is fully insulated with Okolite high-voltage moisture and heat-resisting insulation and protected with weather-resistant non-conducting Okoprene. For 52-page Self-Supporting Cable book available to electrical engineers and plant executives, please address The Okonite Company, Passaic, N. J.

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OKONITE SINCE 1878 *insulated wires and cables*

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1 **HIGH PRESSURE**—*produces HIGH CONDUCTIVITY—gives ultimate electrical characteristics and mechanical strength.*

2 **FEATHERED OFF GRIPPING**—*damps vibration—increases cable life.*

3 **STRONGEST** *type of connector when used with steel, copper or composite strands.*

4 **NO WASTE**—*(a) the connector itself can be used over and over again. (b) no cable wasted by overlapping. Easily disconnected . . . . free from corrosion.*

5 **NO SPECIAL TOOLS**—*connections made quickly and easily with ordinary linemen's tools.*

6 **EASY INSPECTION**—*Inspection holes make visual examination of the connection quick and positive. No guess work.*

Bulletins sent on request.

Electroline Company

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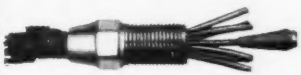
1 SLEEVE—*Cable passed through sleeve.*

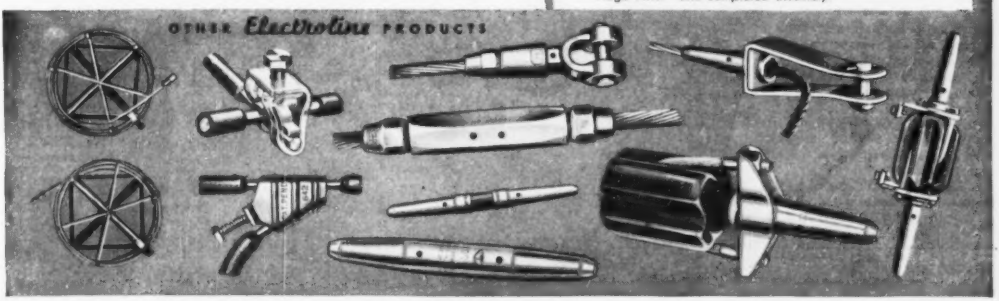


2 SLEEVE-PLUG—*Wires broomed out for insertion of hollow plug.*

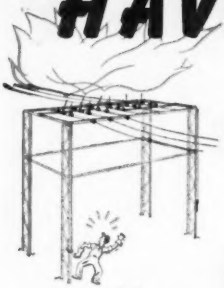
3 SLEEVE PLUG SOCKET—*Plug driven in and wires closed to apply socket.*

4 CUTAWAY ASSEMBLY—*Socket applied showing "Fiege Twist" and completed assembly.*

OTHER *Electroline* PRODUCTS



HAVE YOU SWITCHING

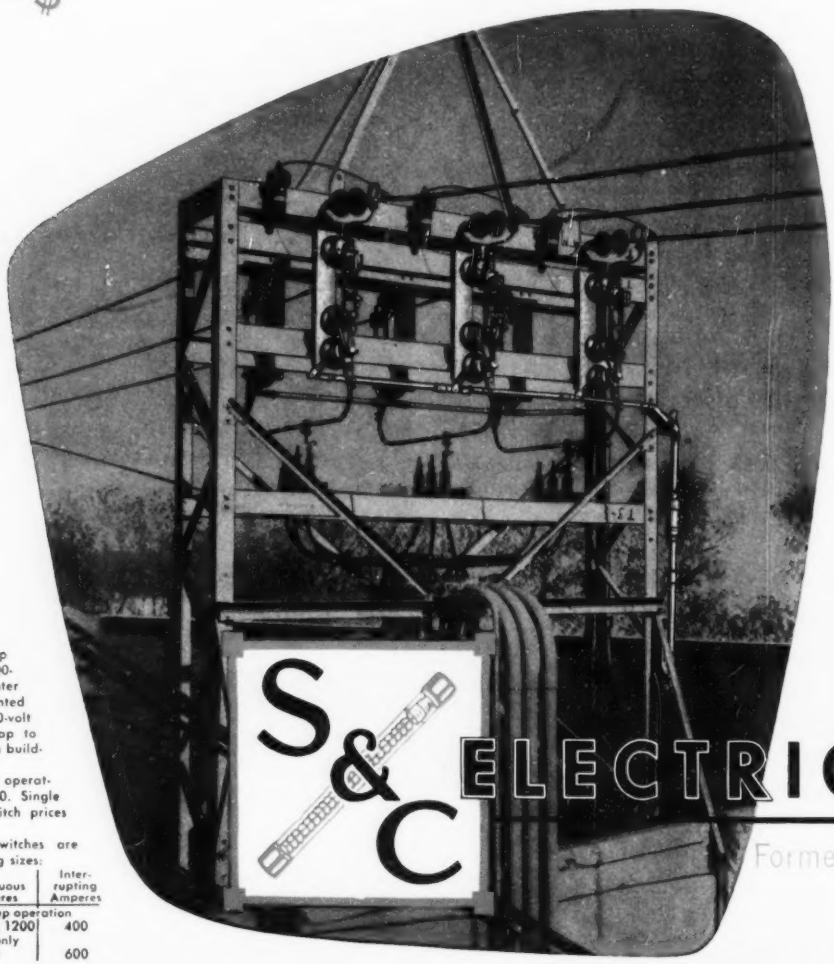


① Where Horn Gap Switches Are Inadequate

because they cannot, under all conditions, safely break magnetizing or charging currents; nor can they interrupt load currents

② Where Circuit Breakers Are Becoming Too Expensive

for non-automatic switching and short circuit protection



Two three-pole, group operated, 7,500-volt, 400-ampere, Alduti Interrupter Switches vertically mounted back to back, in 2,300-volt overhead loop circuit tap to load center substation in building below.

Price each, including operating mechanism, $490.00. Single pole stick operated switch prices as low as $65.00.

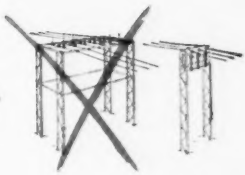
Alduti Interrupter Switches are supplied in the following sizes:

Volts	Continuous Amperes	Interrupting Amperes
For hook stick or group operation		
7500 & 15000	400, 600, 1200	400
For group operation only		
23000 & 34500	600	600

APPLICATIONS . . . . .

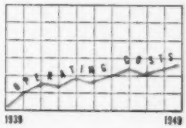
③ Where Structure Design Is Restricted

because horn gap switches can be mounted only in the horizontal upright position, need wide phase spacings, and always require an operating mechanism



④ Where Switching Sequences Are Too Complicated And Costly

because multiple operations—involving breakers, disconnects, and operating personnel—are required to isolate equipment or sectionalize circuits



ALDUTI INTERRUPTER SWITCHES

offer a proved and economical solution to such application problems.

Ten years of actual operating experience in thousands of installations, and many field trials under inordinately severe test conditions, have demonstrated convincingly the ability of these Interrupters to—safely and repeatedly—

Sectionalize either radial or loop distribution and subtransmission circuits, under either load or charging current conditions . . .

Switch load and magnetizing currents of transformer banks . . .

Switch charging currents of capacitor banks.

Because there is NO EXTERNAL ARCING during the operation of Alduti Interrupters: they need not be mounted only horizontally upright, but can also be mounted vertically, or horizontally underhung; hook stick operation can be employed where economy dictates; and phase spacings can be reduced to 18 inches for the 7,500-volt and 39 inches for the 34,500-volt switches. Hence structures can be smaller, connections simpler, and construction cost can be reduced below that of installing horn gap switches. Also, Alduti Interrupters can be installed in cubicles, thus providing—even for subtransmission applications—enclosed "packaged-type" switches, thereby permitting the complete enclosure of all components of a unit-type substation.

When combined with S & C Power Fuses, Alduti Fused Interrupters also provide short circuit protection with fault current interrupting ability up to 40,000 amperes asymetrical, thus making possible the elimination of expensive circuit breakers where automatic switching is not required.

OPERATING, CONSTRUCTION, AND MOUNTING DETAILS, INTERRUPTING RATINGS, AND FIELD TEST REPORTS WILL BE MAILED ON REQUEST

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4421 Ravenswood Avenue
Chicago 40, Illinois

☐ Please send complete information on .....7.5 kv, ...15 kv, ... 23 kv, ...34.5 kv Adluti Interrupter Switches

☐ Have representative call

Name ..... Title .....

Company .....

Street & Number .....

City ..... Zone ..... State .....

COMPANY

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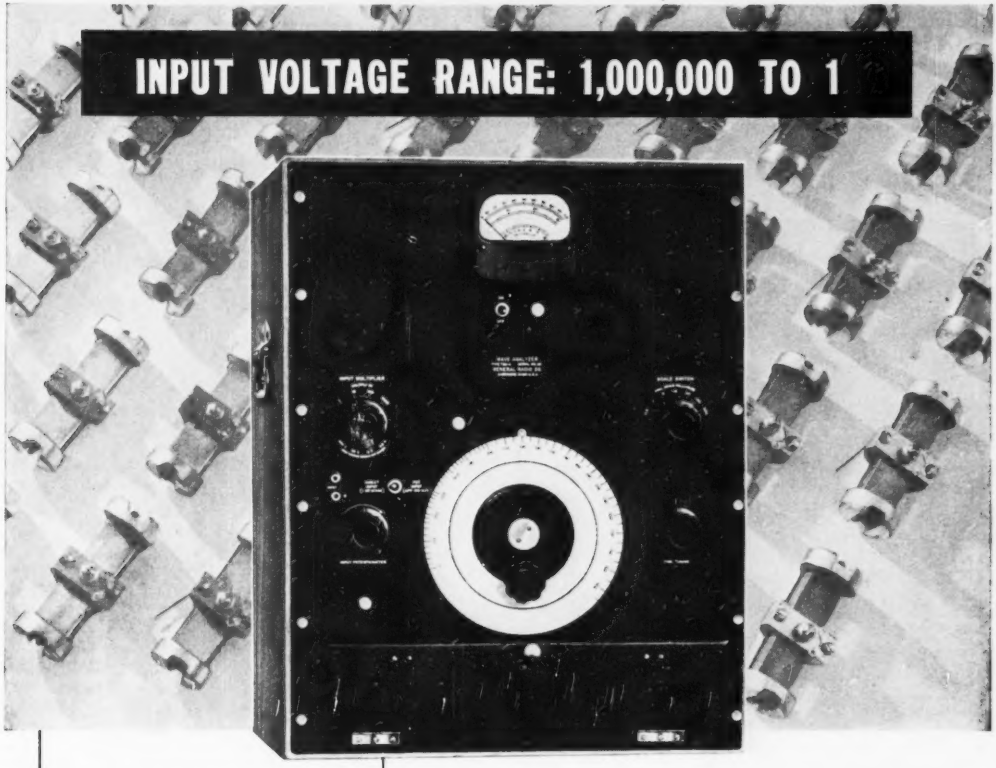
INPUT VOLTAGE RANGE: 1,000,000 TO 1



SPECIFICATIONS

- **FREQUENCY RANGE:** 20 to 16,000 cycles
- **SELECTIVITY:** About 4 cycles flat-top band width. Response is down 15 db at 5 cycles, 30 db at 10 cycles, 60 db at 30 cycles from peak
- **VOLTAGE RANGE:** 300 microvolts to 300 volts full scale. Over-all range is divided into four major ranges, each of which is divided into seven scale ranges.
- **VOLTAGE ACCURACY:** Within $\pm 5\%$ on all ranges
- **HUM:** Suppressed by at least 75 db
- **INPUT IMPEDANCE:** 1 megohm for direct voltage measurements; 100,000 ohms with input potentiometer
- **ACCURACY OF FREQUENCY CALIBRATION:** $\pm$ (2% + 1 cycle)
- **BUILT-IN CALIBRATORS:** For both voltage and frequency
- **PRICE: TYPE 736-A WAVE ANALYZER $920.00**

This analyzer offers the simplest, most accurate and most direct method of measuring the amplitude and frequency of the components of any complex electrical waveform.

In its essentials it consists of a heterodyne-type vacuum-tube voltmeter with a highly selective i-f filter using three quartz bars. At only 60 cycles from resonance the attenuation is down by 75 decibels, yet tuning is very easy by virtue of the 4-cycle flat-top characteristic at resonance. Standards for both voltage and frequency are built into the analyzer and can be used to check its calibration at any time.

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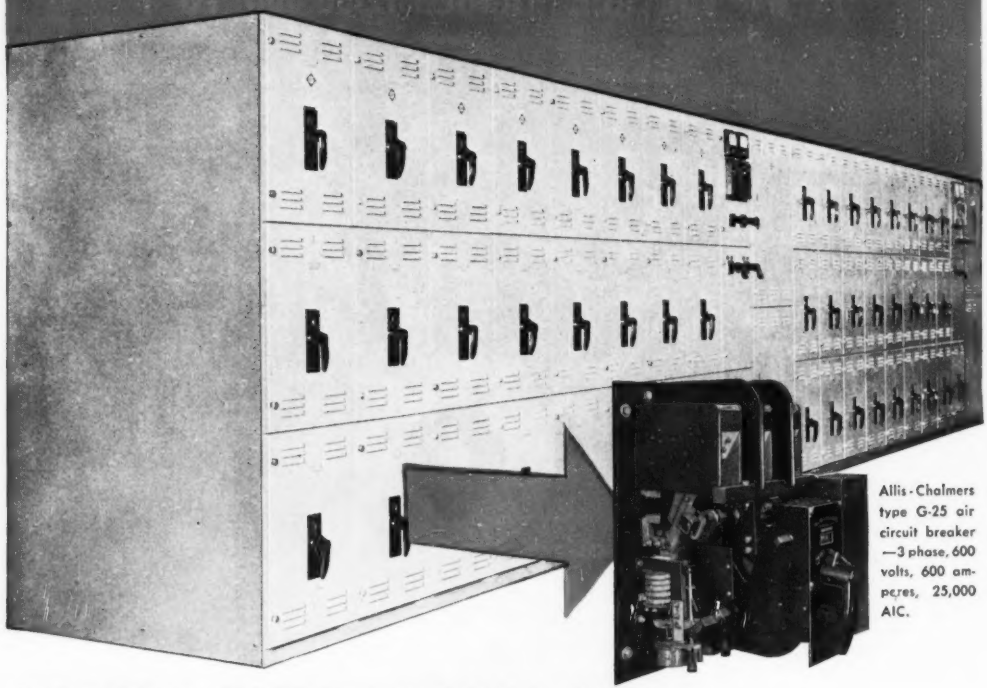
ALLIS-CHALMERS LOW VOLTAGE METAL-ENCLOSED SWITCHGEAR



Allis-Chalmers type G-25 air circuit breaker —3 phase, 600 volts, 600 amperes, 25,000 AIC.

MODERN INSTALLATIONS NEED

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NEW INSTALLATION DESIGN demands *modern* switchgear . . . inside and out! On both counts you can depend on Allis-Chalmers metal-enclosed low voltage units.

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Low voltage units are factory assembled and completely wired for easy installation . . . just bolt them down, complete cable connections and put into operation. Maintenance is easier, too, because adjacent circuits need not be disturbed when inspecting drawout units. Simply replace the withdrawn breaker with a spare and the circuit is back in operation.

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Allis-Chalmers type G air circuit breakers are insensitive to shock and vibration under normal duty. Allis-Chalmers low voltage switchgear is available for 600 volts a-c and below where 15,000 to 100,000 amperes interrupting capacity is required.

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Insist upon and get the protection afforded by the name "Copperweld"* on the ground rods you use. This famous name identifies the only ground rods made by the exclusive Molten-Welding process—in which a thick covering of protective copper is inseparably and continuously welded to a core of high strength alloy steel. The inseparable union of these two metals, which can be accomplished only by Molten-Welding, provides the combination of stiffness for easy driving—and permanent rust-resistance for long life.

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THE ONLY GROUND ROD WITH A THICK COPPER COVERING INSEPARABLY MOLTEN-WELDED TO A STIFF ALLOY STEEL CORE IS STAMPED "COPPERWELD"

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They withstand exposure to ozone... assure trouble-free operation at the higher voltages.

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MEANS BEST PROTECTION FOR YOUR EQUIPMENT

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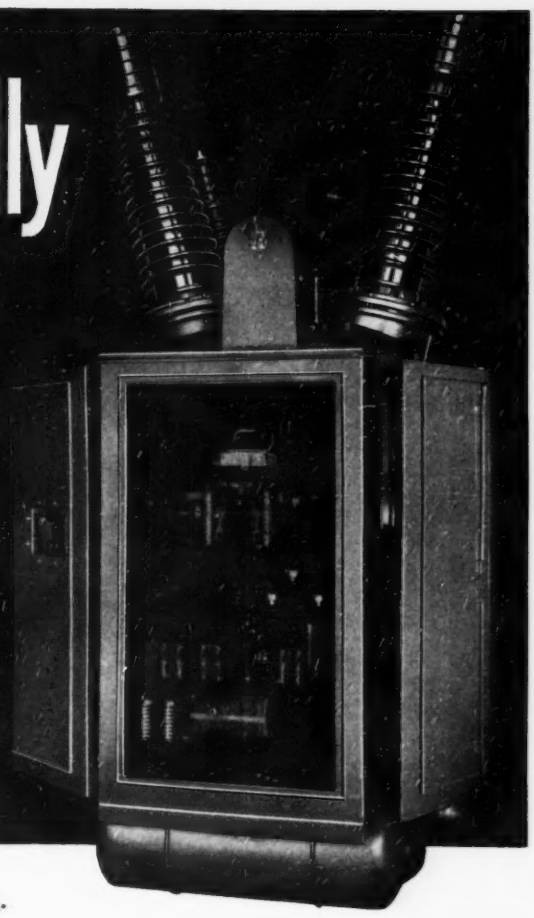


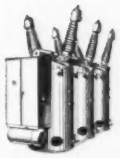
MECHANICALLY TRIP-FREE action instantly releases contacts from closing force when closed on a fault... permits high contact acceleration unhindered by closing cylinder back-pressure or toggle inertia. You get instant, complete contact opening under all tripping conditions.

With this powerful Allis-Chalmers electro-pneumatic operator, highest possible system stability and service continuity are maintained. The breaker cannot be held closed on a fault . . . and operator mechanism is quickly recoupled to permit fast reclosing—within 20 cycles. Pneumatic operation furnishes reliable, high-speed contact closing economically—requires only fractional horsepower motor.

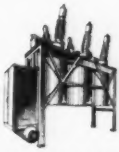
This *mechanically trip-free* electro-pneumatic operator is just one of many features you get on Allis-Chalmers oil circuit breakers. For details on any rating, contact your nearby A-C representative. Or write direct. A 2625

ALLIS-CHALMERS, 932A SO. 70 ST.
MILWAUKEE, WIS.

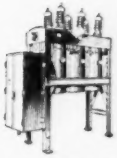
IT'S STANDARD EQUIPMENT ON THESE ALLIS-CHALMERS OIL CIRCUIT BREAKERS



TYPE BZO-160 . . . 69 to 230 kv — 3- or 5-cycle opening, 20-cycle reclosing



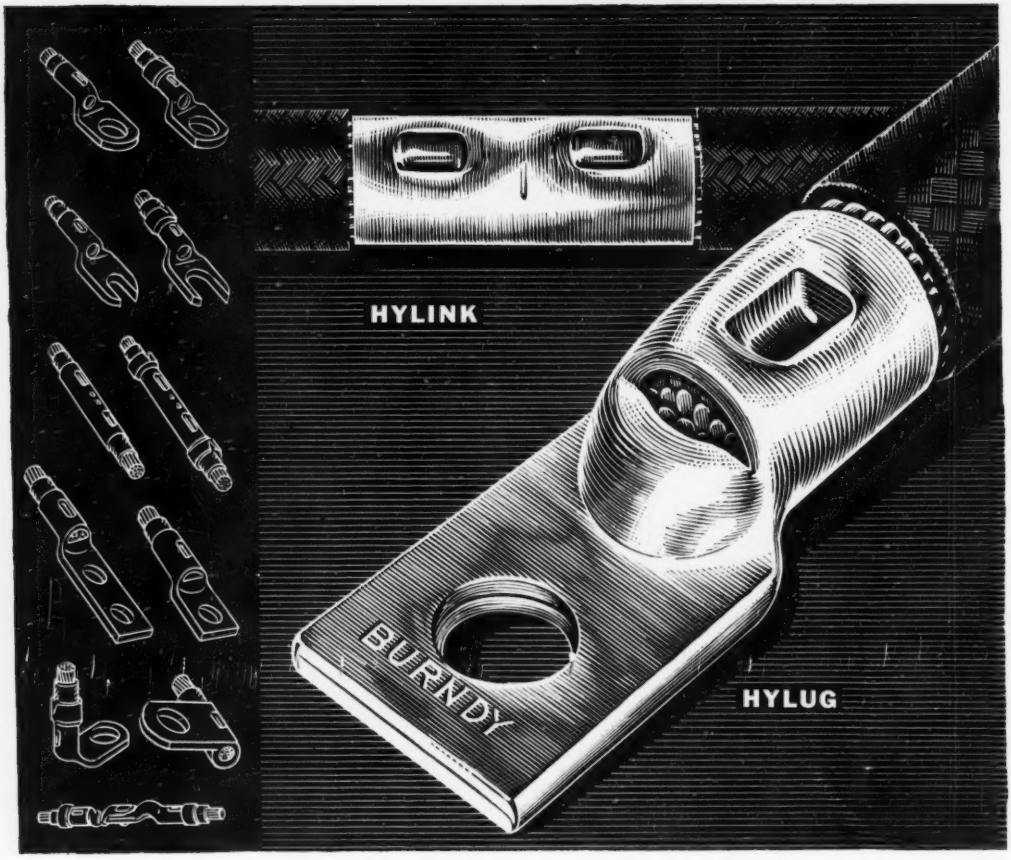
TYPE FZO-151 . . . 69 kv . . . frame-mounted—5- or 8-cycle opening, 20-cycle reclosing.



TYPE FZO-150 . . . 15 to 46 kv—8-cycle opening, 20-cycle reclosing

ALLIS-CHALMERS

Pioneers in Power and Electrical Equipment from Generation through Utilization



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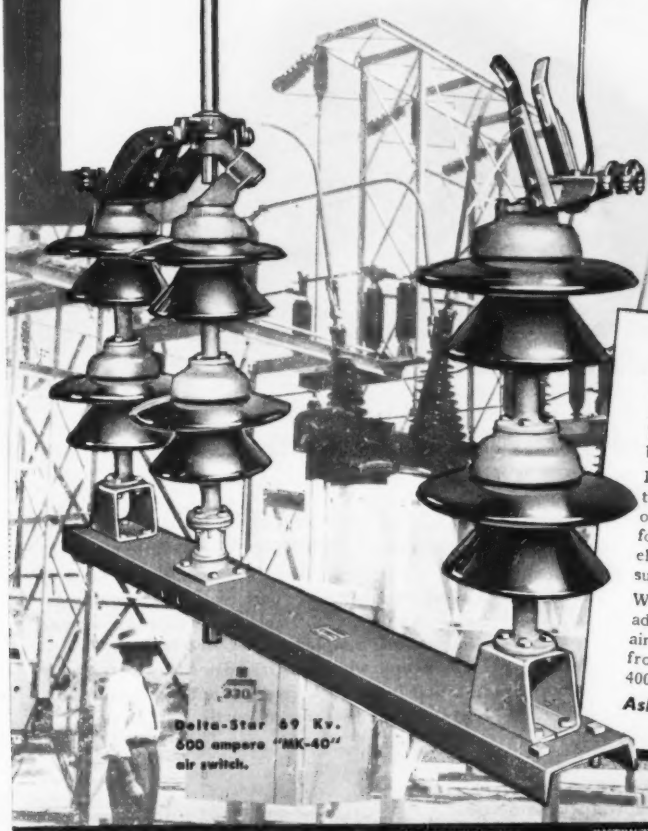
It provides substantial construction! . . . All-around simplicity! . . . Improved contact design! . . . Minimum number of moving parts! . . . Simple and powerful blade actuating mechanism!

All these advantages contribute to ease of operation and insure long trouble-free service.



Delta-Star 69 Kv. 600 ampere "MK-40" air switch.

A fully controlled blade movement turns the blade free of contacts and simultaneously raises it to a vertical position... blade is automatically locked in both opened and closed position.

Improved, high pressure, silver to copper contacts at both ends of the blade plus ample material for heat dissipation, insure high electrical conductivity and superior thermal characteristics.

We'll be glad to demonstrate the advantages of the new "MK-40" air switch. Available in ratings from 7.5 Kv. to 230 Kv. and 400 amperes to 6000 amperes.

Ask for Publication 4807

DELTA-STAR ELECTRIC COMPANY

MAIN OFFICE AND FACTORY — 2400 Block, Fulton St., Chicago 12, Ill.
NEW YORK OFFICE — 140 Cedar St., New York 6, N. Y.

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CANADIAN ASSOCIATE
Canadian Line Materials Limited, Toronto 13, Canada

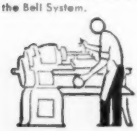
Young man with good connections

In a Bell telephone central office, this Western Electric installer is connecting thousands of wires to new equipment to provide more and better service.

Here's one of 18,000 trained Western Electric installers who do this job for Bell Telephone companies. Crews are working in some 1,600 central offices to connect new equipment which, like your telephone, is made by Western Electric.

• **Western Electric is part of the Bell System—has been since 1882. This assures closest cooperation between people who *design* telephone equipment, people who *make* it and people who *operate* it. Their teamwork has given this country the best telephone service on earth.**

MANUFACTURER of telephone apparatus for the Bell System.



PURCHASER of supplies for Bell Telephone companies.

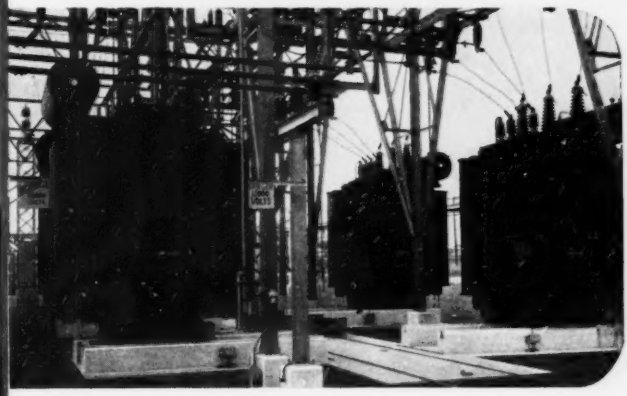
DISTRIBUTOR of Bell telephone apparatus and supplies.

INSTALLER of Bell System central office equipment.

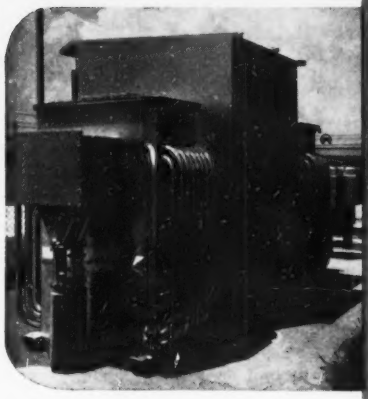
Western Electric

A UNIT OF THE BELL SYSTEM SINCE 1882

power
FOR PRODUCTION



This bank of Wagner Power Transformers is part of the main substation at the Houston, Texas Refinery of Shell Oil Company, Inc.



A Wagner Unit Substation, one of several small substations serving in the same plant.

In addition to power transformers, Wagner manufactures Rural Line, Distribution and Substation Transformers. Whatever your transformer requirements may be Wagner can furnish the exact type of transformer to fit your need.

Wagner
TRANSFORMERS
can solve your power planning problems

These power transformer installations, part of the recent catalytic cracking and lubricating oil plant extension at the Houston, Texas Refinery of the Shell Oil Company, are typical of Wagner Transformer installations for industrial power systems.

Wagner Power Transformers have established enviable records for continuous service in thousands of industrial plants and on transmission lines from coast to coast. Carefully controlled production methods, highest quality materials, rigid inspection and tests, and more than fifty-five years of transformer engineering experience mean that you can count on Wagner Transformers for dependable performance, plus added safety . . . added economy . . . and added service.

Users of power transformers will find it to their advantage to consult Wagner engineers on all of their transformer requirements. Wagner transformer users also profit by speedy, nationwide service facilities. Twenty-nine branch offices, manned by trained field engineers, are ready to serve you. Write for Bulletins TU-180 and TU-181 for information on the complete line of Wagner Transformers.

Wagner Electric Corporation

6456 PLYMOUTH AVENUE, ST. LOUIS 14, MO., U. S. A.

Consult Wagner Engineers on All Transformer Problems

BRIDGE BRAKES • POWER AND DISTRIBUTION TRANSFORMERS • MOTORS • UNIT SUBSTATIONS

T49-2

ELECTRICAL EQUIPMENT AND AUTOMOTIVE BRAKE PRODUCTS

Are YOUR lines holding the poles up?

STOP POLE DECAY

. . . with OSMOPLASTIC groundline treatment*

● Things aren't always what they seem on the surface. Sometimes you have to dig for the facts and these facts can be mighty embarrassing. For instance: It will cost $80 to $100 (including change-over) to replace this decayed pole. YET . . . OSMOPLASTIC, an inexpensive, more potent preservative, COULD HAVE SAVED IT for about 4% of that amount.

Osmose Treating and Inspection Programs have brought important savings to prominent utility companies everywhere AND CAN DO THE SAME FOR YOU. Our experienced field crews will inspect all or any part of your system, treat defective poles with Osmoplastic and hand you back a concise, up to date record of pole conditions. Poles that are too far gone for treatment are marked for replacement and you're all set . . . with no inconvenience or confusion and all at a SURPRISINGLY LOW COST.

Decide now to cut your maintenance cost and eliminate as many pole replacements as possible. Let us submit estimates for your particular job and explain how we can do this work without any disruption to your organization. Or, if you prefer, we will supply the materials for application by your own crews. Get the facts! Write for Free Booklet described below!

**Reg. U. S. Pat. Office.*

Send for this
FREE BOOKLET
Here's the whole story in a nutshell! Write us for your copy of "How to keep your Poles UP and Costs DOWN". No obligation, naturally!

OSMOSE WOOD PRESERVING COMPANY OF AMERICA, INC.

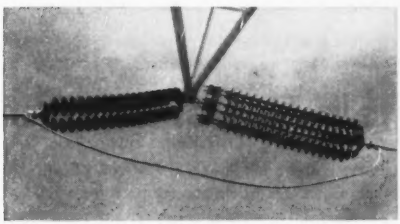
BUFFALO 12, NEW YORK

BTC

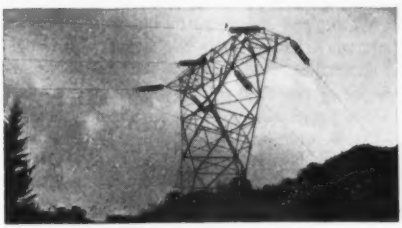
FORGED STEEL HI-LINE HARDWARE

Used on Another Important Transmission Line

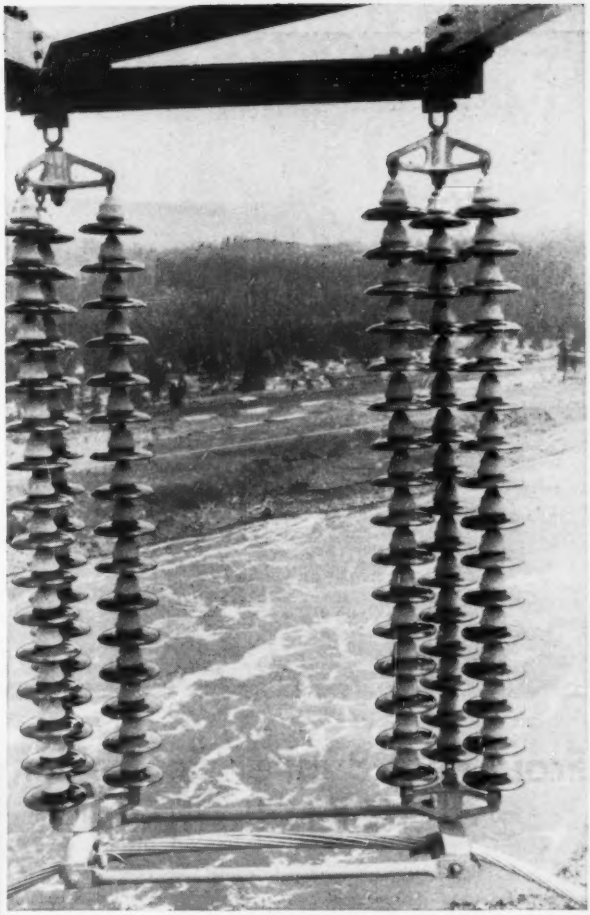
Sold only through your insulator manufacturer



Conductor dead-ending at Bradford Island Crossing was through Six-String Strain Yoke Sets using springs to equalize Insulator String tension. Triple Strain Yoke Sets were used on the inland side of towers.



One of the Dead-End Towers showing Triple Strain Yoke Sets and Jumper Suspension Strings.



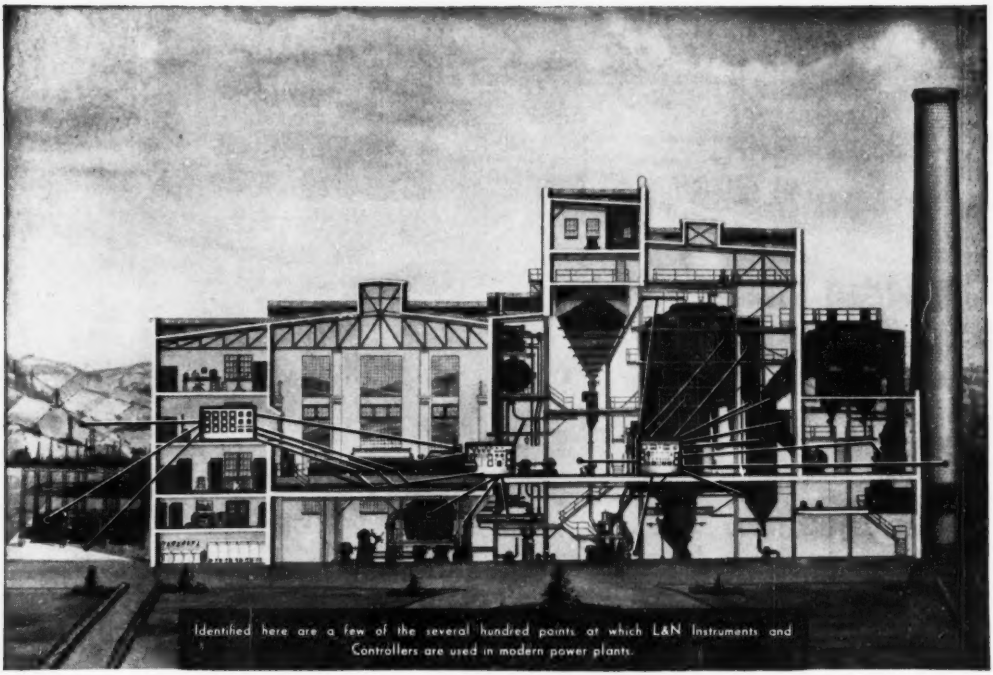
The suspension construction at Bradford Island Crossing used two high strength forged steel clamps each connected to Yoked Triple Insulator Strings.

The Bonneville-Vancouver line is but one link in the Bonneville Power Administration's extensive transmission line network which has been an important factor in the development of the Pacific Northwest.

This 230 kv. line, built in 1939, is 35.6 miles long. The conductor, except for the river crossing described below, is 795,000 cm. A.C.S.R., supported, at 12750 pounds tension, on steel structures. At the Bradford Island Columbia River Crossing the special 801,900 cm. A.C.S.R., under 26,000 pounds tension, is suspended on high river-bank towers and dead-ended on next adjacent inland towers.

All Suspension Clamps, Strain Yoke Sets, and Fittings by BTC. Service record has been very satisfactory.

THE BREWER-TITCHENER CORPORATION, CORTLAND, NEW YORK



Identified here are a few of the several hundred points at which L&N Instruments and Controllers are used in modern power plants.

From Fuel Bunker To Tie Line— L&N Instruments Help Power Output

From fuel bunker to switch yard and tie line, L&N offers a completeness of instrumentation unobtainable from any other single source. Recording and controlling needs may originate at both ends of the turbo-generator shaft, or anywhere along its length, and be handled by L&N instruments with outstanding ease and success.

At the steam end of the shaft are Metermax Combustion Control; Micromax Superheat Control; Micromax and/or Speedomax Recorders which give coordinated strip-chart records of all boiler and mill temperatures; recording of CO_2 smoke density, steam purity and pH.

Turbine Board Instruments

In the turbine room are Micromax strip-chart Recorders for temperatures of the feed water and condensate cycle; condenser temperatures; bearing and oil temperatures; electrolytic conductivity, and flow in connection with the Centrimax Flowmeter.

At the electric end of the shaft are Micromax and/or Speedomax Strip-Chart Recorders for temperatures in bearings, stators, fields, transformers and cables; for frequency; for remote voltage. L&N Load-Frequency Control and Load Telemetering apply to either the station or system, or both.

Complete Board Design and Construction

The trend to complete, central-control boards and cubicles has always been advocated by L&N. Highly specialized engineering and production facilities give you equipment arranged for proper operation. It reaches you assembled, wired and tested; ready for installation. You save heavily in your own time and responsibilities.

Further information will be sent on request. Address Leeds & Northrup Co., 4938 Stenton Ave., Philadelphia 44, Pennsylvania.

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

LEEDS & NORTHRUP CO.

Jrl. Ad N-460 (1)

76 YEARS MANUFACTURING EXPERIENCE back every THOMAS Insulator

Seventy-five years ago, The Thomas Company started ceramic manufacture. During this three-quarters of a century, Thomas has pioneered many firsts in the insulator field.

Consider Suspension-Strain Insulators as an example. The Thomas Company built the *first* commercial Cap-and-Pin Suspension Insulator back in 1907. Since then, we have constantly refined the design and improved its quality. The result is the Thomas Suspension-Strain Insulator you see here . . . the only insulator with such an enviable and unsurpassed "pedigree".

Despite these unusual times, when quality and skilled workmanship could be sacrificed, you can specify Thomas Insulators with full confidence that quality and value cannot be surpassed.

All Thomas Insulators have been constantly improved . . . quality workmanship is still the watchword of all production. Each insulator has the plus values to meet every type of line condition. Standard designs may be selected for your toughest assignments.

EARLY THOMAS DEVELOPMENTS

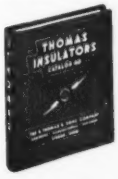
First High-Voltage, Multi-Part, Pin-Type Insulator. First Cap-and-Pin, Suspension-Strain Insulator.

Many of these are still in operation. They are the best proof of the long life and stamina of Thomas Porcelain.

1873 THOMAS INSULATORS our 76th year RELIABILITY 1949

YOUR LETTERHEAD BRINGS THIS FREE CATALOG

. . . which illustrates and describes the complete Thomas Line. Enclosed in a loose-leaf binder, it provides a ready reference for all Transmission-Distribution Insulators and Associated Line Hardware. New Insertions, as issued, are sent to all catalog holders.

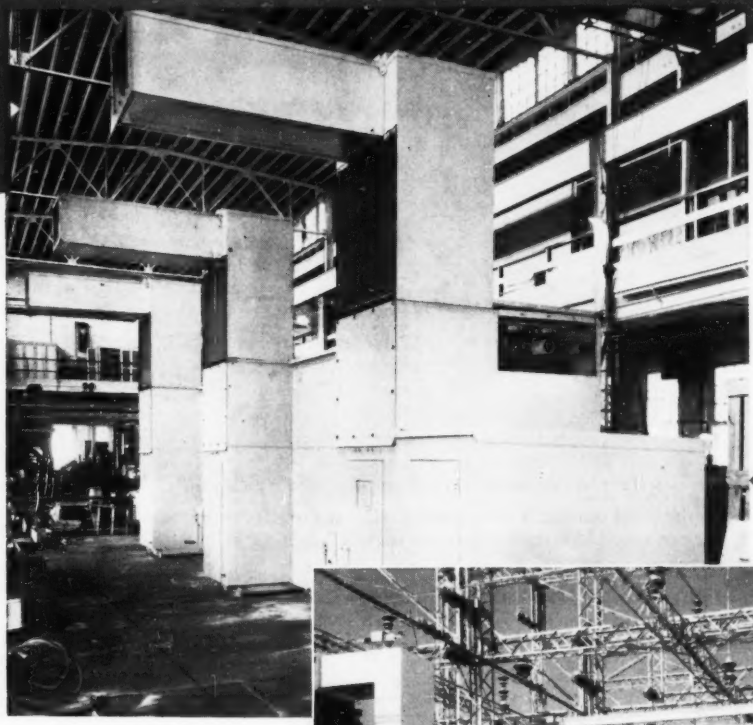


The R. Thomas and Sons Co.

LISBON, OHIO
NEW YORK CHICAGO
AGENTS IN PRINCIPAL CITIES

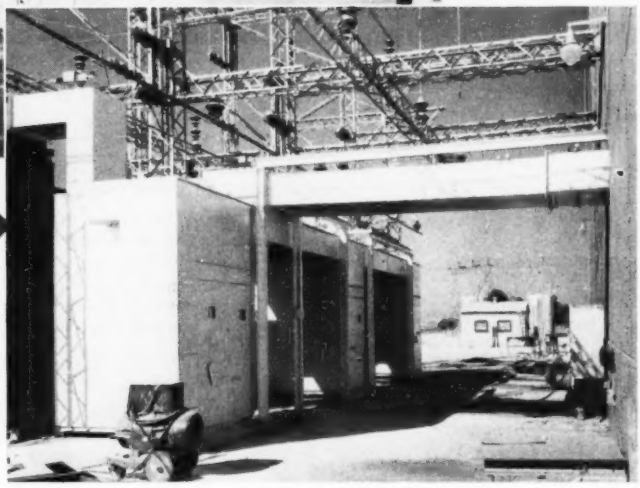
FACTORY ASSEMBLY of ELPECO "Unitized" Bus Run

Saves Installation Time and Cost



Unitized
means
DESIGNED
ASSEMBLED
TESTED
SHIPPED
INSTALLED
as a unit

Ready to Ship



Being Installed

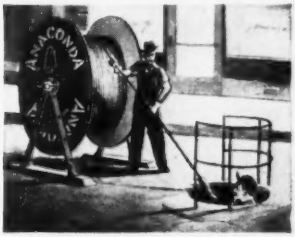
You save many man hours of assembly, fitting and aligning on the job with Elpeco unitized Bus Run. Investigate it for your next job.

ELPECO

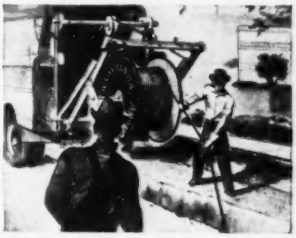
Duo-Roll Air Switches • Hook-Stick Disconnecting Switch • Outdoor Sub Station • Bus Run • Bus Supports • Power Connector Fittings

ELECTRIC POWER EQUIPMENT CORP., 412 North 18th St., Philadelphia 30, Pa.

IN THE AIR—In single or grouped conductors, with self-supporting aerial assemblies, Durasheath truly is a one-type cable for all-type use.



IN CONDUIT—Moisture, oil, acid resistance of neoprene jacket make Durasheath an ideal cable for this application.



UNDERGROUND—Toughness of neoprene jacket assures long life of Durasheath when installed directly in the ground.

For power distribution between farm buildings, in street lighting systems, airports, mines, industrial plants, railroad signal systems, real estate developments—to mention a few—Durasheath gives you a *run* for your money. You can use Durasheath in a continuous run that is partly underground, in conduit and in the air. Here's why:

Tough neoprene jacket is *unaffected by electrolysis*, corrosion and extremes in temperature.

Light weight permits *self-supporting* aerial assemblies.

Greater flexibility makes handling easier.

It's rugged: high resistance to oils, flame, abrasion, cutting, impact and the moisture, acids and alkalies found in the soil.

Specify Durasheath: available in small sizes or large, single or multi-conductor, to carry from 0 to 5,000 volts.

Durasheath

ANACONDA WIRE & CABLE COMPANY

ANACONDA
from mine to consumer

25 Broadway, New York 4, N.Y.

ORANGEBURG
FIBRE CONDUIT

Cables "Walled In" For Lifetime Service
UNDERGROUND

The ELECTRICAL ENGINEER realizes that the push of a button floods the home with light or sends power pulsing into the industrial machine *only when all's well with the underground cables.* ORANGEBURG CONDUIT helps keep these *life-lines long-lived.*

The *impermeable* walls and tight taper sleeve joints of ORANGEBURG CONDUIT protect cables *permanently* from corrosion . . . just as its smoother bore and low coefficient of friction safeguard it *from* Cable Sheath Abrasion, *from* Pulling Tensions, *with* Cable Movement . . . facts proved by ORANGEBURG'S 50-year record underground.

Above ground, the news is also good . . . because ORANGEBURG CONDUIT combines unique strength and toughness with light weight, ease of handling, transportation and installation.

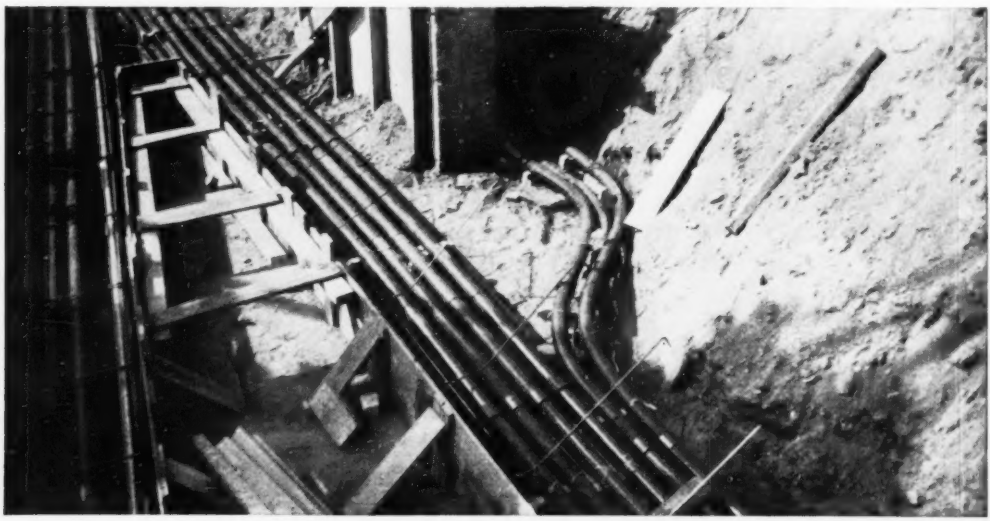
These features together with its permanent resistance to corrosive ground waters and chemical wastes, provide a product that is low in *initial* and *maintenance* cost.

For more complete information write today for ORANGEBURG Catalog No. 49. Keep it for ready reference in your files.

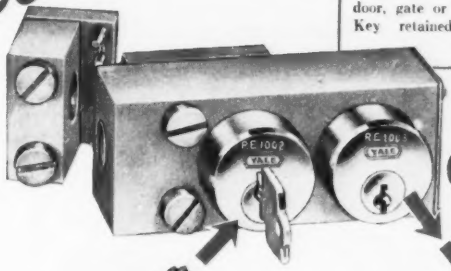
ORANGEBURG STANDARD—For installation with concrete encasement.

Distributors • Graybar Electric Co., Inc.
General Electric Supply Corp.

Orangeburg Manufacturing Co., Inc., Orangeburg, N. Y.



SAFETY *Made to Order* ---



TYPE D — Detachable. Can be mounted on cell door, gate or compartment. Key retained with door locked open.

TYPE B — Can be mounted on operating handle of disconnecting device. Key released when locked open.

with the **R&IE**

KIRK KEY INTERLOCK SYSTEM

1. **KEY INTERCHANGE,** following an orderly predetermined sequence, provides almost unlimited safety. An authorized operator is prevented from doing the unauthorized thing.

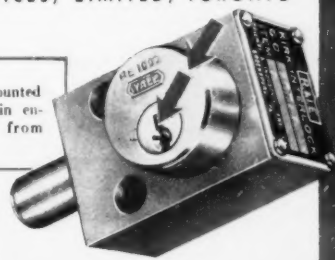
2. **INDIVIDUAL LOCKS** are mechanical (sliding bolt). Types B, D and F, shown, meet the basic mounting requirements. Standard lock barrels and solid metal housing contribute to the safety of the system.

3. **UNLIMITED OPERATING SCHEMES** can be arranged from combinations of units as shown, or multiple units of any of them. The Safety factor of any operation where electrical or mechanical apparatus is involved will be greatly improved when maintenance or inspection procedure is controlled with a Kirk Key Interlock System.

Full description, application and typical schemes are shown in detail in Bulletin No. 1700.

RAILWAY AND INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.

IN CANADA—EASTERN POWER DEVICES, LIMITED, TORONTO



TYPE F — Can be mounted on any protective device in enclosure. Key available from Type D multi-lock.

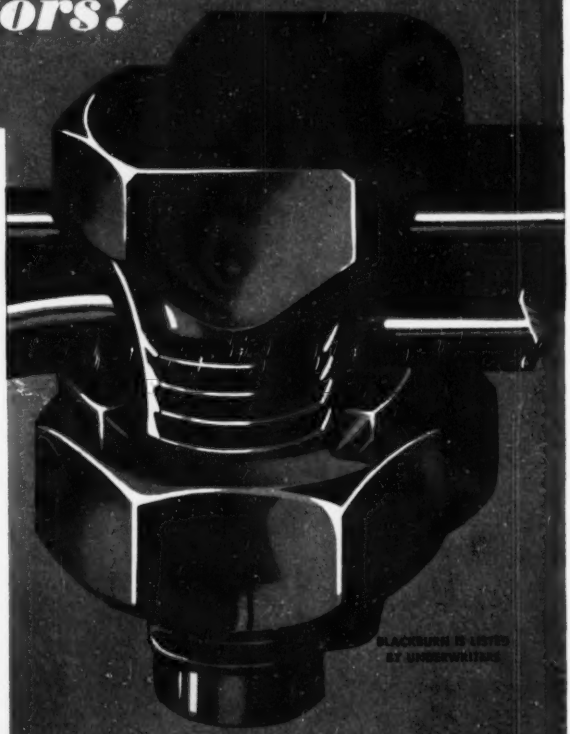
The Check List

- CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS
- DISCONNECTING SWITCHES INDOOR AND OUTDOOR
- HORN GAP SWITCHES
- INTERRUPTER SWITCHES
- CUTOUTS AND THERMO-RUPTERS
- DISTRIBUTION EQUIPMENT
- SWITCH OPERATING MECHANISMS
- SUBSTATIONS
- OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES
- KIRK INTERLOCK SYSTEMS
- AUTOMATIC SWITCHING EQUIPMENT
- METAL CUBICLES
- TESTING DEVICES

The A-B-C of Connector Buying:

Ask Your Jobber for Blackburn HI-STRENGTH Connectors!

TIME-TESTED under the most severe service conditions, BLACKBURN Hi-Strength Connectors are the top quality product in their field today. That's because they're made of DURONZE — 50% stronger than hard copper or commercial bronze. They are trouble-free on the line. They produce a more efficient connection. They last longer — will not season crack. They will not twist or distort when tightened up, and can be used over and over again. In short, they are the strongest—most economical—most satisfactory connectors made!



BLACKBURN Hi-Strength CONNECTORS

America's No. 1 Connector

MILLIONS IN USE THROUGHOUT THE WORLD

Over 100 Conveniently-Located Jobbers' Stocks

WRITE FOR NEW CATALOG

FEATURING THE FULL LINE OF BLACKBURN PRODUCTS

JASPER BLACKBURN PRODUCTS CORP.

FIRST, MADISON AND CLINTON STS. • ST. LOUIS 6, MO.

Phone CEntral 3807

HERE'S WHY NEOPRENE PRODUCTS DO SO MANY JOBS SO WELL

They resist
OXIDATION by air, oxygen, ozone—have outstanding resistance to aging.

They resist
HEAT—are exceptionally stable at temperatures up to 250° F.

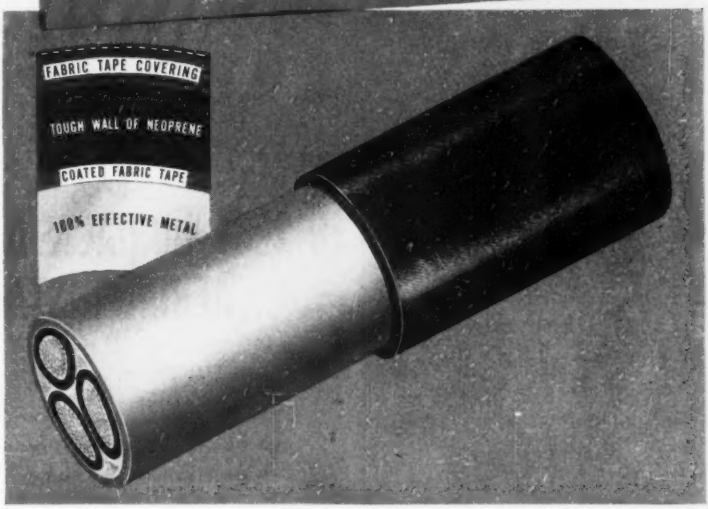
They resist
SUNLIGHT AND WEATHERING—in a class by themselves in resistance to rubber's worst enemies.

They resist
OILS, SOLVENTS, MOST CHEMICALS—set the standard for oil resistance throughout industry.

They resist
ABRASION, CUTTING, CHIPPING—are tough and durable under severe service conditions.

FREE! THE NEOPRENE NOTEBOOK—Interesting stories . . . new, unusual applications of neoprene. Write E. I. du Pont de Nemours & Co. (Inc.), Rubber Chemicals Division G 3 Wilmington 98, Delaware.

Better rubber products are made with Du Pont NEOPRENE



For example . . .

Neoprene covering protects lead sheath on underground cable against corrosion and mechanical damage

IN MANY areas, lead-sheathed cable won't stand up in underground service. Corrosion . . . chemical or electrolytic . . . is a principal reason for failure. Mechanical damage during installation and from metal fatigue during operation are other contributing factors.

The cable shown above was designed to overcome these shortcomings. In this improved construction, a special neoprene covering replaces a portion of the lead sheath. With neoprene as the first line of defense, ample protection against corrosion and mechanical damage is provided. In addition, the neoprene covering is highly resistant to moisture, oils, chemicals and is non-flammable.

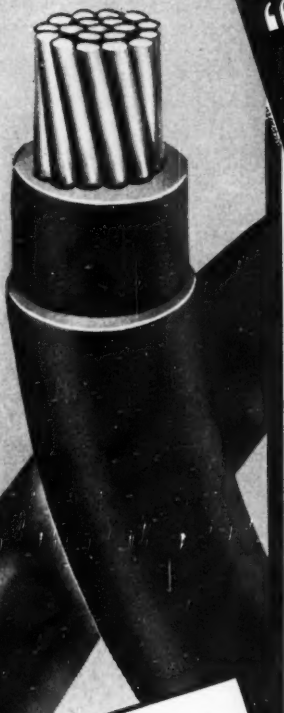
Even in locations where corrosion is known to be unusually severe, the tough neoprene covering assures complete protection. Fifteen years of trouble-free service have been reported on this cable from test areas in the field.

It is just another instance where neoprene's superior qualities contribute to extended service life and efficiency of power cable. So, insist on cable with a neoprene covering. It means long life, low maintenance, fewer replacements.

Tune in to Du Pont "CAVALCADE OF AMERICA"—Monday nights, NBC Coast to Coast

Specify a cover of
NEOPRENE
The rubber made by
DU PONT
REG. U.S. PAT. OFF.
BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

Triangle's



"TRIOPRENE"

High Performance Neoprene Jacketed Cable

for

DIRECT BURIAL...DUCT SYSTEM ...AERIAL INSTALLATIONS

that are

More Flexible . . . Lighter . . . Longer Lasting . . . Easier to Handle

— at substantial savings in cost!

Here's what Triangle's "Trioprene" special cable means to you:

- **Greater Flexibility.** No metal tapes, no lead sheath, no confining braid — just f-l-e-x-i-b-l-e rubber insulation, f-l-e-x-i-b-l-e "Trioprene" jacket!
- **Smaller Diameter.** Elimination of customary layers of tape, braid and armor saves space — with no sacrifice of protection!
- **Lighter Weight.** The only metal is the copper conductor . . . weight is cut to the bone!
- **Non Magnetic.** No steel is used in "Trioprene" jacketed cables.
- **Easier Handling — Easier Splicing.** You don't have to wrestle with "Trioprene" cables! Because they are lighter, smaller, more flexible — they handle as easily as building wire.

. . . and in addition . . .

- **Lower Cost.** Where economy must be achieved with no sacrifice of quality, compare the cost of the cable, the freight, the labor for installing — then "Trioprene" jacketed cables are the answer!

For EXTRA quality — at NO extra cost — insist on "TRIOPRENE"!

I.P.C.E.A. TYPE RR . . .
U.L. TYPE USE

"Trioprene" Parkway Cable, Type RR, is available in sizes from No. 14 to 500,000 C.M., for operating potentials up to 5,000 volts. "Trioprene" Underground Service Entrance Cable, Type USE, is made in sizes from No. 14 to 500,000 C.M., for potentials up to 208 volts to ground.

If It's "Trioprene" It's Made by Triangle . . .
If It's Made by Triangle IT MUST BE RIGHT!

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ARTERIES FOR ELECTRICAL INCORPORATED SYSTEMS

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"GLAZON" BUILDING WIRE • BARE WIRE • ARMORED CABLE • "GLAZON" TRIEX NON-METALLIC SHEATHED CABLE • SERVICE ENTRANCE, SERVICE DROP, VARNISHED CAMBRIC BRAIDED OR LEADED, TRIOPRENE TRENCH, POWER AND PARKWAY CABLES • RIGID CONDUIT HOT-DIPPED GALVANIZED • ELECTRIC METALLIC THIN WALL CONDUIT • FLEXIBLE STEEL CONDUIT

FREE!

New Booklet to help you sell more (and better)

SCHOOL LIGHTING

16 pages of facts and photos

FREE . . . all the copies you need

Here's a real selling tool . . . an easy-to-understand booklet that points out the need for better school lighting—then *shows what steps can be taken to get a school lighting program started.*

Put this booklet to work for you. Send it to educators, parents, PTA members—all the many hard-to-reach people who must support a school lighting program. *Not fixture advertising!* This is an understandable, objective case history of a planned school lighting program that will help overcome that "What can we do about it" public indifference. Let it help you SELL school lighting . . . the need for it . . . how to get it.

159

IT'S EASY TO SEE WHEN IT'S

DAY-BRITE *Lighting*

Day-Brite fluorescent fixtures are engineered for every seeing task. Distributed nationally by leading electrical suppliers.

Authoritative **because it's an actual account of how the citizens of Denver, Colorado, completely relighted their Public School buildings.**

Fact-filled **— step-by-step through the Denver story — answers such questions as:**

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- ◯ **How does color of paint affect lighting?**
- ◯ **What about new wiring?**
- ◯ **What about maintenance?**

. . . and many, many others.

. . . as many copies as you need . . . courtesy of Day-Brite! Clip and mail coupon—TODAY!

To: DAY-BRITE LIGHTING
5425 Bulwer Avenue, St. Louis 7, Missouri
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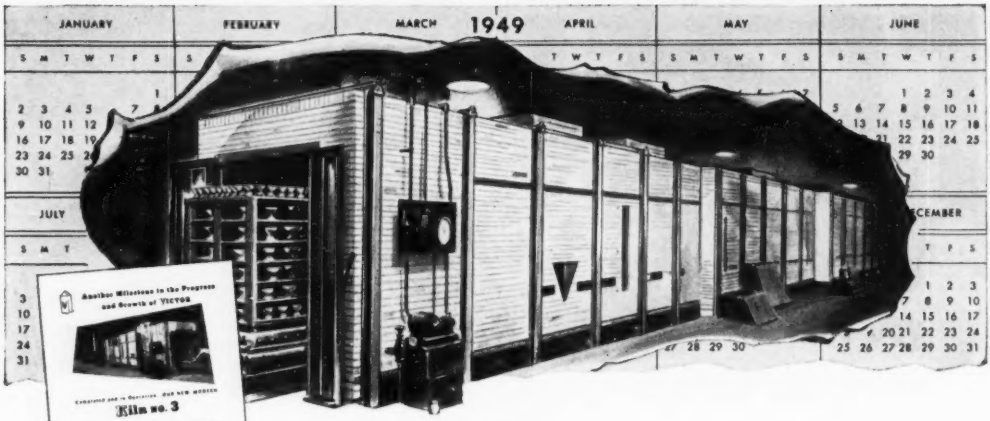
Please send me, free and postage prepaid, _____ copies of your new booklet, "It Happened in Denver's Schools." I understand there's no obligation.

Name (Please Print) _____

Address _____

City _____

State _____



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NOW...ONLY 1 YEAR LATER

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Proof that Victor, America's fast-growing insulator company, is geared to handle *your* demands for *Quality*, *Quantity* and *Dependable Deliveries* in high voltage insulators.

Leading power utilities and manufacturers insist on the famous wet-process porcelain insulators made by Victor because of their *unsurpassed performance*. These insulators are fired in the latest-design tunnel kilns with the most *modern* equipment—to assure dependability in mechanical and electrical properties. Victor ceramic engineers, electrical engineers and *skilled craftsmen* have the experience and know-how which combine to produce a product of uniform quality, uniform dimensions, uniform appearance! With our battery of modern kilns, we are better equipped than ever to serve your needs. We are at your immediate service for consultation on standard or special porcelain requirements.

VICTOR
INSULATORS Inc.
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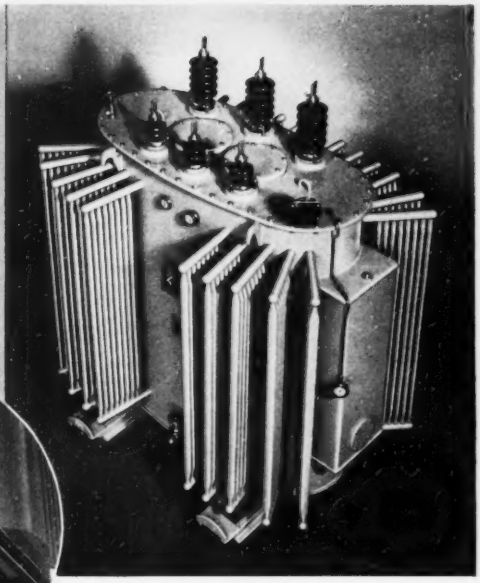
Look for this trade mark of enduring service

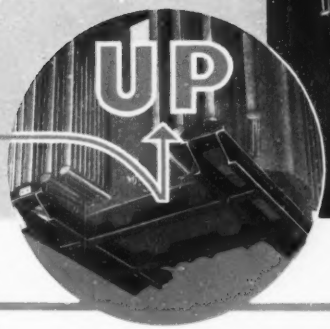
V

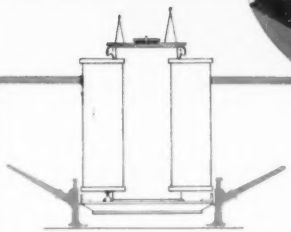
Pennsylvania STANDARD PARTS POWER TRANSFORMERS

Designed Right... Built Right...

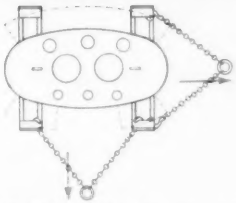
FROM THE BOTTOM UP



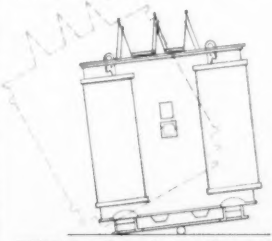




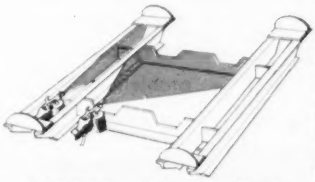
JACKING — Structural steel base members extend to ends of radiators. Radiators offer no interference to jacking. Clearance provided for base of jack to extend under jack lugs. This allows toe of jack to enter all the way under jack lug.



PULLING — Jack lugs are constructed so that a standard hook can be placed in the jack lug to pull the transformer in any direction.



TIPPING — Base design takes into consideration transformer's center of gravity. The largest rolls used cannot tip transformer past its center of gravity.



PAINTING — Ports are provided in base members to ventilate bottom of transformer tank, and to facilitate complete painting of the base and tank bottom. Rust will not attack the tank bottom under these conditions.

Now available in the following sizes:

Three Phase: Up to 10,000 Kva, 34 Kv.
Single Phase: Up to 5,000 Kva, 34 Kv.

A NEW, IMPROVED structural steel base represents one of the outstanding design features in Pennsylvania's new line of Standard Parts Power Transformers.

This base was designed by Pennsylvania Development Engineers after a thorough study of the requirements of a representative group of transformer users. The sketches illustrate how this new base simplifies jacking, pulling, rolling and painting.

Here is another concrete example of Pennsylvania's Engineering Ingenuity.

You'll discover something new if you write for Booklet No. 1492.

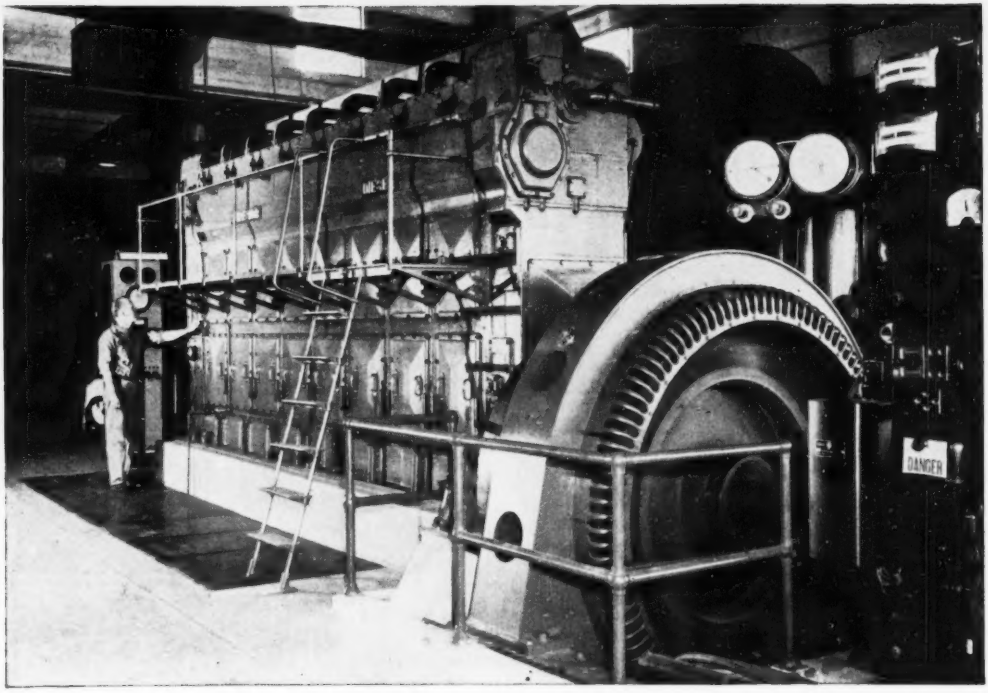
Look to Pennsylvania Standard Parts Power Transformers for *lower prices and faster deliveries.*

Inert Gas-Oil Seal

Sealed Tank

Inert Gas Pressure

Pennsylvania TRANSFORMER COMPANY
PITTSBURGH 12, PENNSYLVANIA



THEY'RE TURNING NIGHT INTO DAY

An Iowa town is enjoying brighter nights and dependable electrical power because they installed a Superior Diesel. The engine they chose is a supercharged model 80-GX-8. It will deliver dependable power for many years under continuous heavy duty service.

Superior Supercharging provides greater power output from the same engine. This overall increase in mechanical efficiency means lower fuel costs per kilowatt hour at maximum and partial loads. Operation of Superior Supercharging is fully automatic. No control devices are necessary.

One of our field representatives will be glad to show you how a Superior Supercharged Diesel can solve your power problems. Just write and tell us when he can call.

THE NATIONAL SUPPLY COMPANY
SUPERIOR ENGINE DIVISION
Plant and General Sales Office: Springfield, Ohio

THE NATIONAL SUPPLY COMPANY NSCO

Superior DIESEL

In Electric Razors, Too . . .

MALLORY TUNGSTEN CONTACTS

Lead a Busy Life

THE buzz in an electric razor is actually the noise of contacts making and breaking. They operate so fast that the resultant sound is a continuous buzz. But not too fast for those tough little Mallory Tungsten Contacts to handle. Their performance is flawless—their life so long that electric razors offer years of dependable service.

These Mallory Contacts have to be rugged to take a continuous beating like that. Thanks to the most precise and rigid processing control of the tungsten materials, Mallory Tungsten Contacts stand up. Thanks to the resulting interlocking grain structure that keeps down erosion, they perform for long periods of hard operation.

What's Your Problem?

From little electric razors to giant power plants —from airplanes to home circuit breakers— you'll find a wide variety of Mallory Contacts doing the job. Mallory has designed so many types of contacts that even if your problem is an unusual one there's a good chance that Mallory has the right contact to solve it. If not—just call on Mallory engineering to develop one for you. Do it now.

For all kinds of contact materials and service, you can't beat Mallory as a dependable, experienced source.

In Canada, Made and Sold by Johnson, Matthey & Mallory Ltd., 110 Industry St., Toronto 15, Ontario.

Electrical Contacts and Contact Assemblies

P. R. MALLORY & CO. Inc.

MALLORY

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

SERVING INDUSTRY WITH

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Contacts Switches
Controls Vibrators
Power Supplies
Resistance Welding Materials

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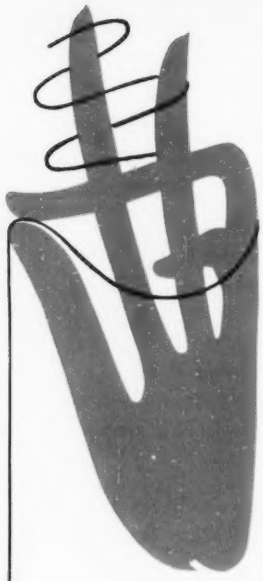

. . the original nickel-chromium heating element wire

CHROMEL resistance wire is available in B & S gauge sizes from 000 down to .0010 for a wide range of electrical heating and resistor applications.

Wherever you find an electrical heating application . . . in household appliances or in industrial processes . . . chances are you'll find durable Hoskins CHROMEL on the job. For CHROMEL, you know, is the *original* nickel-chromium resistance wire . . . the wire that *first* made electrical heating practical. It gets hot, stays hot, lasts a long time. And, for many good reasons, it's been the basic element of the industry for over 40 years. So whether your interest in electrical heating is from a utility load-building point of view, as a manufacturer of appliances, or as a user of electric heat in your production processes, be assured that your best interests are best being served by Hoskins CHROMEL resistance alloy. Complete technical information plus helpful application data is contained in our Catalog M-1 . . . want a copy?

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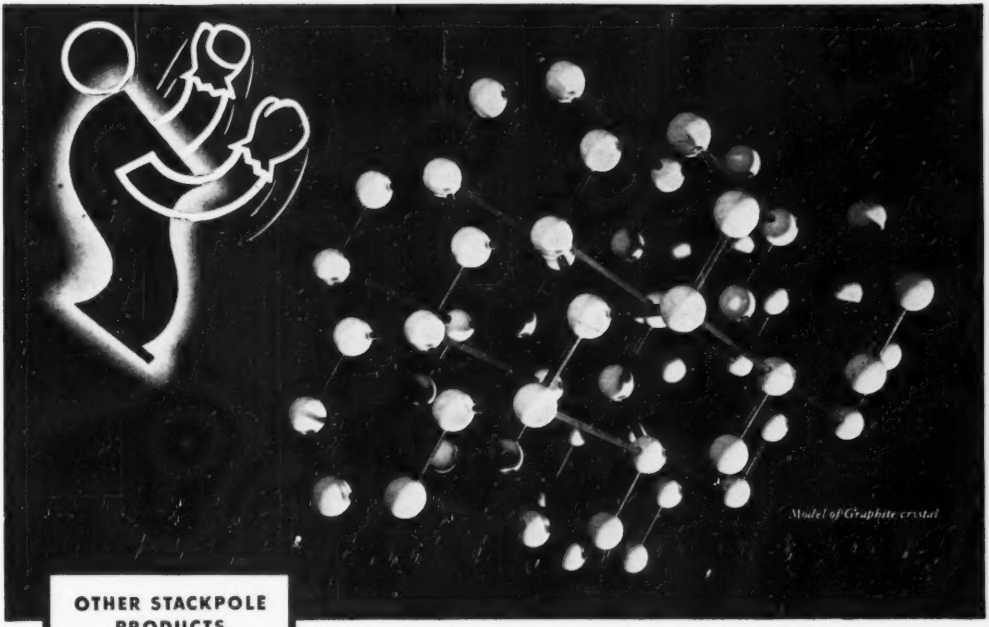
Chromel® nickel-chromium wire

LICKED!

FRICTION...TEMPERATURE CORROSION...SHAFT SEALING AND ARC PROBLEMS...



OTHER STACKPOLE PRODUCTS

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PASTEURIZATION ELECTRODES
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BRAZING FURNACE BOATS
DASH POT PLUNGERS

on 1001 applications

What is YOUR application problem? Need a material that can be heated to 4000° F. and thrown into cold water without cracking . . . that will resist atmospheric surface action while retaining constant contact resistance . . . that will have low friction (graphite) or high friction (carbon) or any intermediate frictional value?

Stackpole Carbon and Graphite components handle all of these assignments—and many more. Chemically, electrically, and mechanically, Carbon and Graphite offer far flung engineering advantages—and, for almost a quarter of a century, Stackpole design and production service has paced the trend in progress along many important lines.

WRITE FOR THIS BIG CARBON GRAPHITE BOOK!

In addition to a wealth of informative data, the new Stackpole Carbon-Graphite Specialties Catalog #40 describes hundreds of items regularly produced. More particularly, it contains interesting evidence of the ability of Carbon and Graphite to solve a broad range of design, engineering and production problems—and of Stackpole's facilities for producing what is needed.

STACKPOLE CARBON COMPANY, ST. MARYS, PA.

STACKPOLE

"EVERYTHING IN CARBON BUT DIAMONDS"

we finish our figure work faster

WITH THE PRINTING CALCULATOR

ACCOUNTANT: My books are balanced faster,
And I know they're all shipshape;
To prove my entries accurate,
I have the printed tape!

PAYROLL CLERK: I love that 10-key touch control,
So fast, so sure, so easy;
I get the payrolls out so quick,
The boss nicknamed me "Breezy"!

BILLING CLERK: I do the work of two machines
On this one calculator;
Its automatic features make
Invoice production greater!

STATISTICIAN: With no reruns to prove our work,
There's not a moment lost;
My staff has doubled output,
And cut down office cost!

Remember, only the Printing Calculator divides automatically, multiplies, adds, lists and subtracts, and *prints* the proof on the tape. So your modest investment really buys two fine machines in one—a calculator that prints and a high-speed electric adding machine.

As the quartet above has learned, printed proof provides increased profits. For the whole cost-cutting story for your company, call our local representative, or write for free booklet to Remington Rand Inc., Dept. EL-3, 315 Fourth Avenue, New York 10, New York.

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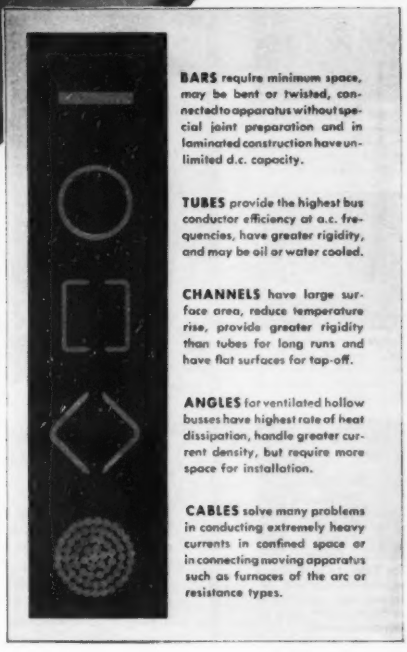

BARS require minimum space, may be bent or twisted, connected to apparatus without special joint preparation and in laminated construction have unlimited d.c. capacity.

TUBES provide the highest bus conductor efficiency at a.c. frequencies, have greater rigidity, and may be oil or water cooled.

CHANNELS have large surface area, reduce temperature rise, provide greater rigidity than tubes for long runs and have flat surfaces for tap-off.

ANGLES for ventilated hollow busses have highest rate of heat dissipation, handle greater current density, but require more space for installation.

CABLES solve many problems in conducting extremely heavy currents in confined space or in connecting moving apparatus such as furnaces of the arc or resistance types.

Ventilated

COPPER CHANNEL BUS

for rigidity, good distribution and low power losses

TWO COPPER CHANNELS arranged to form a hollow square tube with longitudinal ventilating slots vertically above one another offer many advantages.

Possessing greater rigidity than a round tube, they permit long spans between bus supports, and provide good current distribution at normal power frequencies with low power losses. The flat surfaces permit inexpensive tap-offs, the large areas dissipate heat, and the simplicity of arrangement makes for low installation expense.

Each of the five shapes in which Anaconda Bus Conductors are made offers advantages of its own. In all five shapes, Anaconda Copper provides the high thermal and electrical conductivity, strength, toughness and corrosion resistance which make *copper* the preferred material for Bus Conductors.

ANACONDA
from mine to consumer

Anaconda

BUS CONDUCTORS

THE AMERICAN BRASS COMPANY

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Subsidiary of Anaconda Copper Mining Company

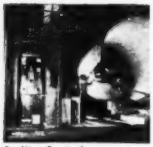
In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

Metallurgical Research conducted continually by recognized specialists who have made major contributions in this field.

Unique Technical Backing of an extensive organization with an international reputation in both process and fabrication engineering.

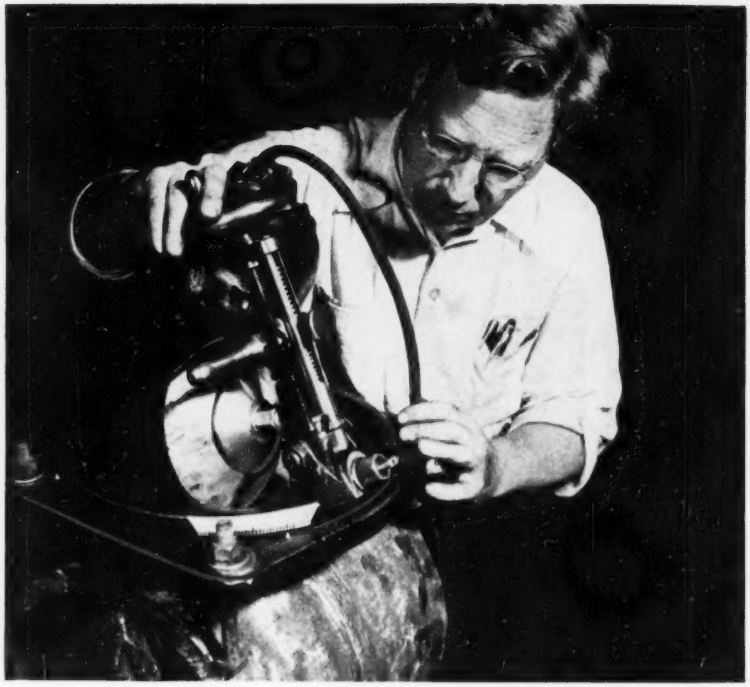
Complete Facilities for the fabrication of steel products from simple forgings to the most intricate 120 foot towers.

Top Welding Performance assured by specially designed equipment and exclusive employment of master operators.



Quality Control embracing the constant application of the most advanced inspection methods, both visual and non-destructive.

On-Time Delivery made possible by a flexible planning group authorized to re-route work to meet promised dates.



Gouging that pays off!

GOUGING has an unpleasant connotation in most lines of business. But when it comes to power piping, "gouging" means longer life and better service from pipe because it shows you what you can't see by just peering at a pipe installation or scrutinizing a manufacturer's stamp.

Let's take a peek at this thing you can't see. It all starts out with the familiar weld-prober shown above. This portable piece of equipment gouges out boat-shaped samples from pipe that is actually in service position. The holes it leaves are carefully refilled by welding and service quickly resumed.

It's what happens to these samples that is important; that's one of the major reasons Kellogg power piping is held in such high repute.

For some time these gouged-out samples have been used in an exhaustive study of the eccentricities of graphitization – the metal disease that attacks high temperature and high pressure piping during service life and seriously impairs its original strength.

There are some seventy-five talented technicians actively engaged in metallurgical study at Kellogg's Jersey City Laboratories. One of their principal programs is the study of graphitization. Much data has been gathered . . . much more will be forthcoming. Everything that is already known goes toward providing better power piping.

Such invisible technical advancement is duplicated throughout every phase of power piping work—from the use of exclusive stress analyzing equipment to the testing of welds on the actual installation site. It is the important advantage you can't see when you buy power piping from M. W. Kellogg.

To master temperature, pressure and chemicals use

M. W. KELLOGG

process equipment

VESSELS • EXCHANGERS • CONDENSERS • HIGH PRESSURE AND HIGH TEMPERATURE POWER PIPING PROCESS PIPING • FORGED AND WELDED FITTINGS . . . IN ALL STEELS, ALLOYS OR SPECIAL COMBINATIONS

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When you need steel... TRY US FIRST

When you need steel, it's always a good idea to try us first. We are constantly increasing our facilities and expanding our organization in order to serve our customers more quickly and efficiently. For example, new warehouse buildings, scientifically laid out to speed zoning and loading, have been erected in a number of our districts. In several other important marketing areas we have opened new warehouses. And all our plants are being equipped with the latest machinery for cutting, processing and handling materials.

This progressive planning has but one object in view—giving you the very best in steel warehouse service.

As rapidly as possible, we are increasing our stocks. If you will check with us, you will find that many grades and types of steel are now available for prompt delivery.

So, try us first—for steel—for metal-working tools, supplies and machinery. Simply telephone, wire or write the warehouse or sales office nearest you.

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United States Steel Supply Company
Dept. M-3-26, 208 S. La Salle St., Chicago 4, Ill.

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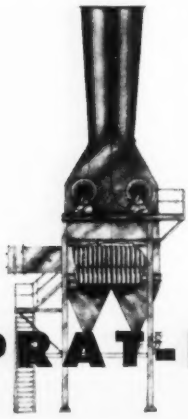
UNITED STATES STEEL

COORDINATION

Prerequisite to Induced Draft Efficiency



Coordination of the components is as important to the efficiency of Induced Draft Equipment as it is to the smooth harmony of a ballet.

Beside the disadvantage of higher cost when installed separately—unit by unit—the non-integrated breeching, I.D. Fan and Stack, in many cases, operate at sub-standard efficiency due to lack of over-all unified engineering.

Prat-Daniel research has evolved an induced draft system that eliminates this problem . . . provides the absolute ultimate in fuel efficiency.

Result—the well-known Thermix Fan Stack! Inlet Breeching, Fan and Stack combined in a single, integrated draft-producing unit that is unbeatable for high level performance.

From boiler outlet to atmosphere, depend on Thermix Fan Stacks to maintain predetermined, constant draft with full efficiency for your boiler.

Our project engineers will be glad to show you the advantages of Thermix equipment. Write for a complete catalog on your company letterhead. *All inquiries should be directed to*

Project & Sales Engineers

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PRAT-DANIEL CORPORATION

Manufacturers of Thermix Equipment

EAST PORT CHESTER, CONN.

Conductor Guards*

Twist on...Twist off...by hand

Easily, Quickly and at Low Cost

Here, the lineman is holding the two strips apart for clearer inspection. In actual application, a motion like "wringing a cloth" is used.

CONDUCTOR GUARDS are simply strips of plastic preformed with such a pitch that when twisted together, they form a tight cylindrical sheath. No special tools are needed to install. The conductor need not be disconnected.

In just a matter of seconds, the lineman wraps the preformed strips around the conductor. The result is a uniform, weather-resistant, tight-gripping guard that gives added insulation and protection against abrasion. Conductor life is prolonged indefinitely.

No other method of conductor protection can be installed so quickly or at such a low cost. For complete details, ask any salesman of American Steel and Wire Company, Locke Incorporated or Line Material Company. Or write directly to us.

Where else can you use them?

? APPLICATION

? APPLICATION

? APPLICATION

While PLP Conductor Guards were designed primarily for the protection of conductors passing through trees, we visualize many other applications. Conductors passing over other lines could well use these guards. Lines passing too close to buildings are another use. Tell us your need and let us determine whether or not low-cost PLP Guards are the answer.

*Protected under Patent No. 2,275,019

PLP COMPANY

PREFORMED LINE PRODUCTS COMPANY

1051 POWER AVENUE • CLEVELAND 14, OHIO

it's new RoLene Polyethylene Covered WEATHERPROOF WIRE

LONGER LIFE
MOISTURE RESISTANT
LIGHTER WEIGHT
SMALLER DIAMETER
ABRASION RESISTANT
RESISTANT TO SUNLIGHT AND WEATHERING
SIMPLE TO HANDLE AND INSTALL

Summed up for you, above, are the outstanding features of RoLene, Rome's new polyethylene covered Weatherproof wire. There are no braids to rot and festoon. Because of reduced wall thickness . . . 3/64" on sizes 12 AWG to 4 AWG . . . and the lower specific gravity of polyethylene, overall weights and diameters of RoLene are less than conventional Weatherproof. This means longer spans of RoLene for the same loading conditions . . . longer life . . . neater appearance . . . easier handling.

Rome RoLene Weatherproof wire is manufactured in sizes 12 AWG through 4 AWG with solid conductors, and in sizes 2 AWG and 1 AWG with stranded conductors. Conductors can be soft, medium hard drawn, or hard drawn as specified.

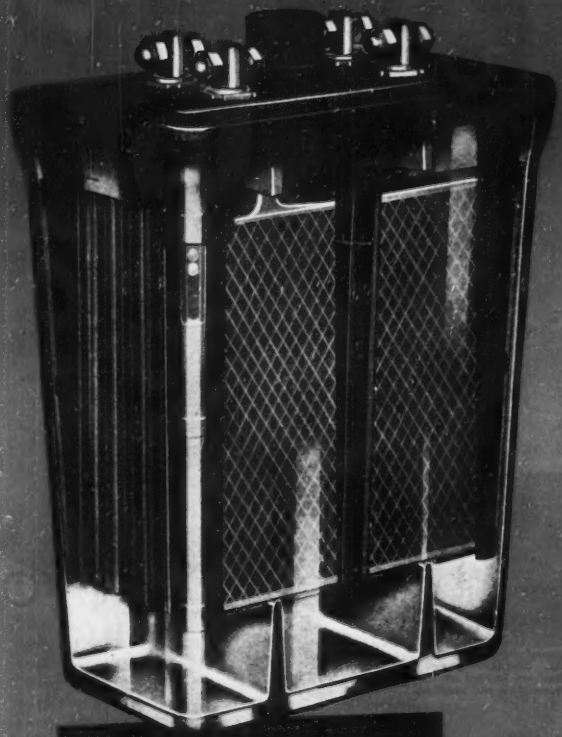
FOR CONSTRUCTION DETAILS WRITE FOR SPECIFICATION WP-3.

FROM BAR TO FINISHED WIRE

ROME CABLE CORPORATION
ROME • NEW YORK

ONLY GOULD Floté

GIVES YOU THESE TIME-TESTED FEATURES



1. **WEDGED ASSEMBLY**—another Gould "first." Corner locks, at points of greatest jar strength, maintain perfect plate alignment throughout battery life.
2. **SUPPORTED ELEMENT**—time-tested in the field. The element rests on lateral bottom supports which are molded into the tough Steel-Glass jar.
3. **MOLDED STEEL-GLASS JAR**—Tough, uniform in dimension, engineered to hold the element permanently in position. A time-tested Gould "first."
4. **BARRICADED OUTSIDE NEGATIVE PLATES**—Rigid, effective shields protect the element.
5. **SPRAYPROOF, LEAKPROOF COVER CONSTRUCTION**—Extra-deep cover seal, acid-tight post seal and sprayproof vent keep covers dry. You can install a Gould Floté near delicate instruments.
6. **POSITIVE PLATES SPECIFICALLY DESIGNED FOR FULL FLOAT SERVICE**—Extra heavy—⅞" thick. Exclusive Gould Floté grid alloy and grid design cut current consumption, increase life.

GOULD FLOTÉ

The only battery specially engineered for full float service—proved by 14 years of customer acceptance.

GOULD

STORAGE BATTERY CORPORATION

TRENTON 7, NEW JERSEY

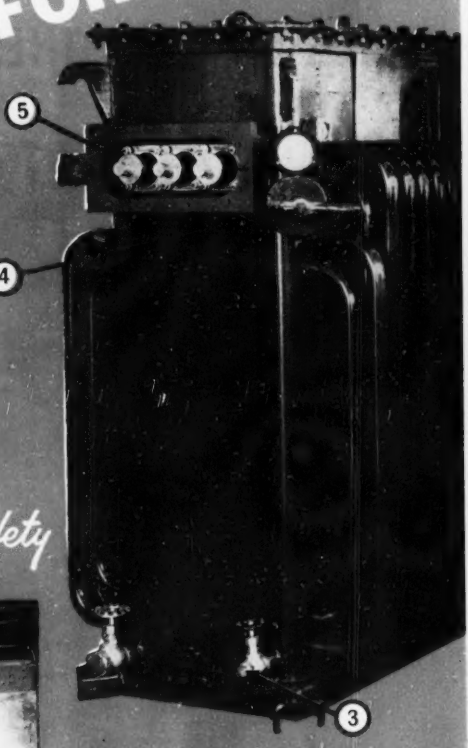
Always Use Gould Automobile and Truck Batteries

Standard

TRADE MARK

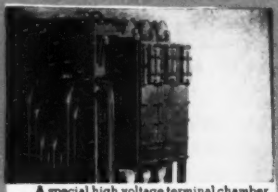
REG. U.S. Patent Office

TRANSFORMERS



A NETWORK TRANSFORMER built to individual requirements

Designed for Efficiency and Safety



1 A special high voltage terminal chamber designed to specific requirements. The three individual compartments permit complete isolation of each phase.

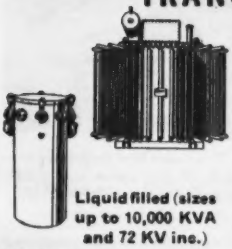
2 Special jack-bosses are provided on ALL Standard power transformers. They are located on corners for easy accessibility and handling.

3 The most practical oil tapping arrangements are made with separate units for drain valve, filter press connection and sampling device.

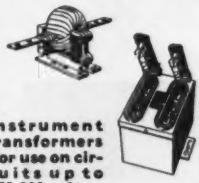
4 The transformers have a safe, externally operated no-load tap changer. It is easy to reach and accessible from floor level.

5 Low voltage flange throat and flexible bus connectors are made to fit any network protector.

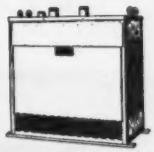
TRANSFORMERS FOR EVERY APPLICATION



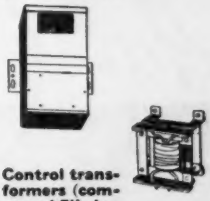
Liquid filled (sizes up to 10,000 KVA and 72 KV inc.)



Instrument transformers (for use on circuits up to 72,000 volts, inclusive)

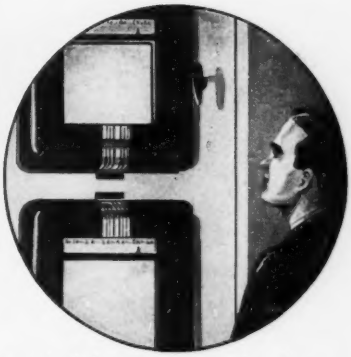


Dry type (up to 1000 KVA and max. voltage ratings of 4800)



Control transformers (compound filled or open type)

part of a shipment to a prominent southern utility company



Accepted by people who know from experience

Your requirements built into every unit.

Standard's network transformers are giving uninterrupted service in congested, heavy-load areas. The maximum of flexibility is provided to accommodate changing load requirements and to permit efficient servicing. They are designed with a minimum of bulk to overcome space problems. Standard's unit substations eliminate the need of costly extra conduit and cables.

While the elements and tanks of Standard's substations conform to general basic designs, your installation requirements are built into every unit. Terminals, bushings and externally mounted auxiliary equipment are located to fit your individual specifications. Switches, and other devices are used as you specify. Our engineers work with you and make Standard's products work best in your operation.

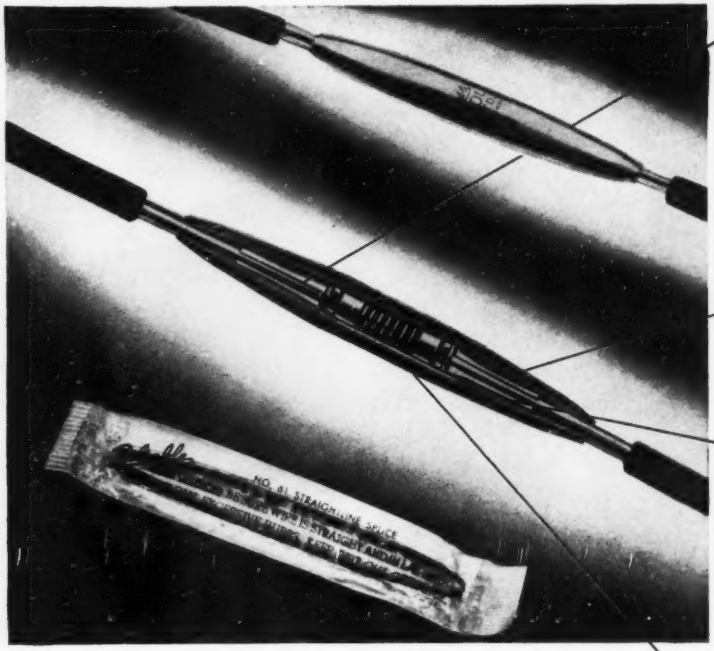
THE STANDARD TRANSFORMER CO.

WARREN, OHIO

For Every Class of Service

Distribution and Power · Current and Potential · Askarel Cooled · Rural
General Purpose Dry Type · Auto Transformers · Street Lighting

Accents on Accuracy



in the manufacture of

STRAIGHTLINE SPLICES

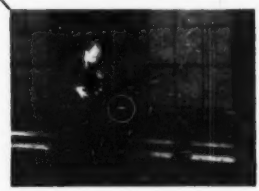
The phenomenal performance of Reliable Straightline splices doesn't just happen. It takes close control over many tiny details to provide a large safety factor beyond normal needs. This gives us assurance that wires will be held, not only in the laboratory where everything is right, but in the field where corrosion, light tensions, dirty wire, stretched wire or other unsatisfactory conditions may be encountered.

And remember — Reliable Straightline splices are now loaded with a neutral, all weather temperature grease which seals joints against corrosion. A tighter grip — important at very light sag tensions — results from this lubrication. To exclude dirt and grit, the splices are individually packed and sealed in sturdy plastic envelopes.

1. The shape and contour of hundreds of tiny points are closely controlled so they will bite sharply without gashing the wire.

2. Tapers of jaws and tubes, checked constantly during manufacture, are held to a small fraction of a degree, and their cooperating surfaces have almost mirror smoothness.

3. Physical limits on jaw material give full hardness after cold working, while preserving a tough grain structure. This hardness is greater than that of mild steel.



4. Accelerated vibration tests check the fine performance that results from accurate control and efficient design of these splices.

Reliable ELECTRIC COMPANY

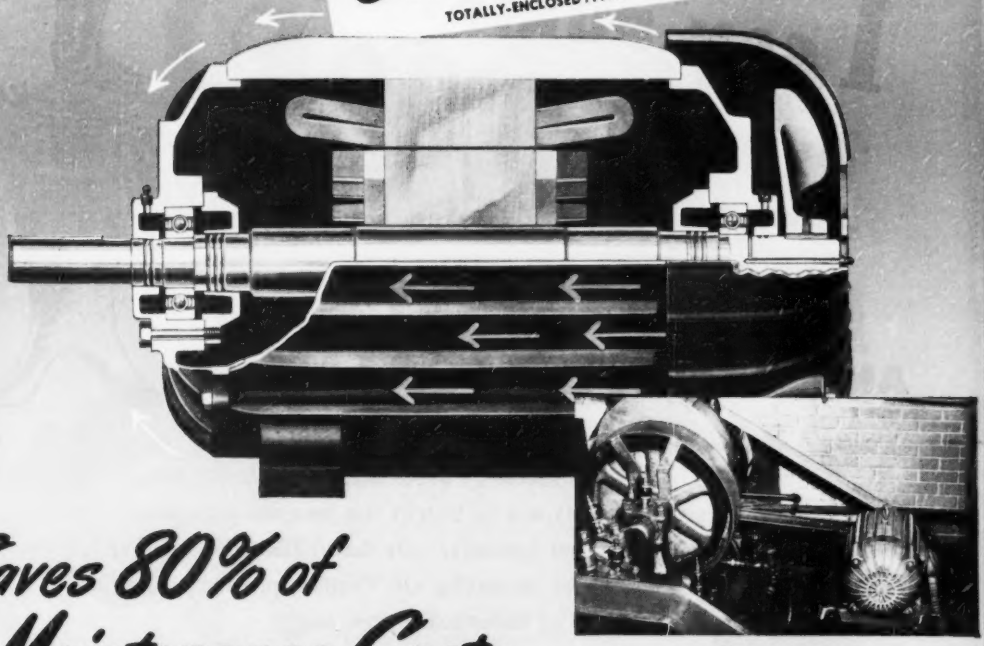
3145 CARROLL AVENUE, CHICAGO 12, ILLINOIS

OVER 40 YEARS OF SERVICE TO THE UTILITIES

POWER-LINE CONNECTORS
AND
CONSTRUCTION SPECIALTIES

CROCKER-WHEELER *Sealedpower* MOTOR

TOTALLY-ENCLOSED . . . FAN-COOLED



Saves 80% of Maintenance Costs

Sealedpower Motor driving a vertical triplex power pump where moisture is excessive.

You can make maintenance savings of 80% and *more* with Crocker-Wheeler Sealedpower Motors. The secret? C-W dollar-saving design. No other totally-enclosed, fan-cooled motor has *exterior* cooling, with the fan-driven airstream blowing over a finned frame, carrying dust and fumes *outside* and *away*. (The outside fins that identify a Sealedpower Motor provide over 150% more cooling surface.)

But that's not all — this motor keeps cooler longer because it keeps cleaner. There's no place for lint or dirt to *collect* . . . nothing to hold heat *in*. Even on the really dirty jobs, a Sealedpower Motor will keep production going many times longer than "ventilating passage" motors, without a shutdown for cleaning.

For years of cool, clean operation and low maintenance cost, specify Sealedpower Motors. They're stock motors made for the toughest service. In new ratings from 3 to 60 hp.

Crocker-Wheeler Electric Manufacturing Company, Ampere 3, N. J. Division of The Joshua Hendy Corp., Branch Offices: Boston, Buffalo, Chicago, Cincinnati, Cleveland, Los Angeles, Milwaukee, New York, Philadelphia, Pittsburgh, San Francisco, Washington, D. C. Representatives in principal cities.

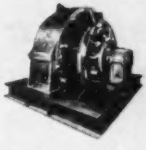
SEND FOR BOOKLET, "It's Different — it's a Dollar-Saver." Tells why the Sealedpower Motor will save money for you.

WHATEVER YOUR MOTOR REQUIREMENTS — CALL ON CROCKER-WHEELER

If Crocker-Wheeler builds it, it's a better built machine.

Horizontal and Vertical Protected-Type Induction Motors

A-C Generators and High Speed Synchronous Motors



Large D-C Motors and Generators

Turbogenerators

CROCKER WHEELER

ELECTRIC MANUFACTURING COMPANY, AMPERE 3, N. J.

Division of Joshua Hendy Corporation

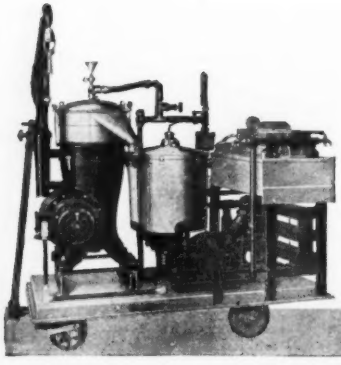
I CAN PURIFY ALL 12,000,000 MOST SAFELY AND ECONOMICALLY!

Electrical World recently wrote that "Some 12,000,000 gallons (of transformer oil) will be bought this year for replacement use in transformers and breakers." De Laval Centrifugal Force, as used in a De Laval Insulating Oil Purifier, provides the safest, economical means of maintaining this oil.

Purification by means of a De Laval Insulating Oil Purifier is accomplished in a single pass. This means that the cost of restoring oil to a high dielectric is very low.

De Laval purification is safe because water once thrown out of the oil is discharged to waste — it cannot recontaminate the oil.

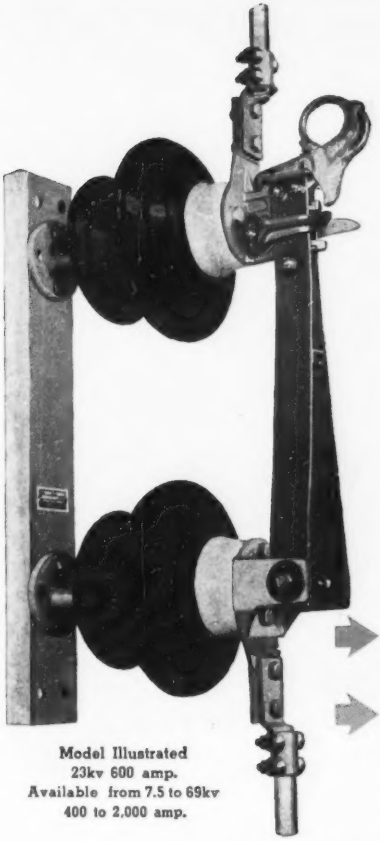
- ***Bulletin No. 350 gives details and sizes. Send for a copy.***



THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

De Laval

INSULATING OIL PURIFIERS



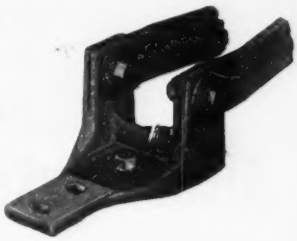
Model Illustrated
23kv 600 amp.
Available from 7.5 to 69kv
400 to 2,000 amp.

Type PBO
DISCONNECT
Switch

The Southern States Type PBO Outdoor Disconnect Switch provides Dependable Performance under all operating conditions . . .

All current-carrying parts of non-ferrous, non-corrosive metal.

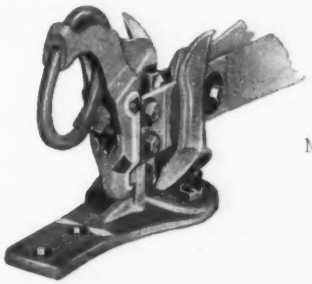
Trussed, hard-drawn copper blade will stand toughest closing shock. Rigid blade guides assure positive operation. The blade can't miss even when switch is slammed shut.



Automatic pry-out helps break hardest ice . . . makes opening easier under normal conditions.

Extra large ring makes hookstick engagement quick, easy and sure.

Positive contact is assured by high pressure wiping action of accurately machined surfaces at both jaw and hinge ends.



Meets all NEMA and AIEE standards.

Southern States Equipment Corp.

HAMPTON GEORGIA

Representatives in:

BIRMINGHAM, ALA.	CHICAGO, ILL.	KANSAS CITY, MO.	DALLAS, TEX.
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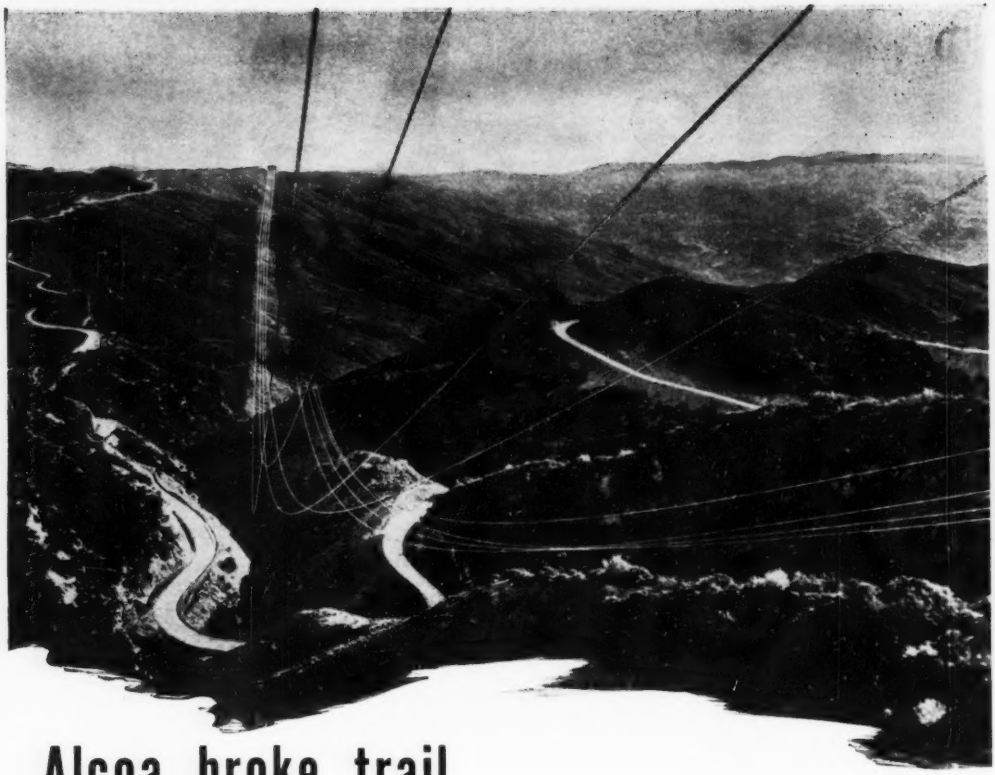


Alcoa broke trail for the giant steps to follow

Marching uphill and down with giant strides, Alcoa Aluminum Cable Steel Reinforced carries the energy that brightens homes, powers factories, moves trolleys and trains.

Old stuff to utility men, surely.

But not to the young Aluminum Company of 40 years ago. Scoffed at then, for advancing the idea that aluminum, an unknown metal, might help carry the nation's power, Alcoa nevertheless drove ahead, bound to test its idea.

Tested and proved, aluminum transmission met still another roadblock. No manufacturer cared to introduce this new wire commercially. So the young company—just 21 years away from a little shed on Pittsburgh's Smallman Street—set up its own cable stranders. Alcoa Aluminum Cable was born.

Then came the problems. Aluminum alone wasn't strong enough under many conditions; a steel core was added making it even stronger than other conductors. Alcoa ACSR was born. Increased strength permitted the economy of higher tensions and longer spans; vibration threatened to create fatigue, shorten life of conductors. Alcoa Research developed armor rods and dampeners to counteract it.

The job isn't done. It never will be. Research by Alcoa—at New Kensington, Pa., across the Texas plains; in its unique testing laboratory at Massena, N. Y.—is going on right now. Alcoa, pioneer in ACSR, will have the answers.

ALCOA® *Aluminum* CABLE AND ACCESSORIES

ALCOA ALUMINUM

HERE'S on-the-job Proof of Westinghouse Instrument Performance!

Universal Tube Test Station—model 733AS—designed and manufactured by the Radio Corporation of America.

Where Accuracy, Simplicity, Readability mean so much they choose . . .

Westinghouse Instruments

. . . *unfailing performance* and *co-ordinated space-saving design* . . . these, too, were instrument "musts" for the receiving tube test station manufactured by RCA.

Westinghouse Instruments easily met these requirements. The result . . . an exact, diverse and rapid control over the quality of all modern types of receiving tubes.

What Are YOUR Electrical Measuring Problems?

Would they include . . . reliable performance? . . . styling? . . . size? . . . readability? . . . or different types of service? . . . portable? . . . switchboard? . . . panel? . . . recording?

The completeness of the Westinghouse line of electrical measuring instruments will answer your special or ordinary problems. Every Westinghouse Instrument is backed by more than 60 years of skill and experience in every field of industry. J-40366

Westinghouse Instruments Also Provide You With . . .

- Dials that *stay* white under all conditions
- Magnets that stay permanent
- Pivots with high shock capacity and low friction
- Springs that remain constant for life
- Quick delivery of more different ratings and types
- Complete nationwide service

Westinghouse Instrument Specialists are available in the field for consultation on your instrument problems. Call your nearest Westinghouse office, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

Send for Booklet B-2209-A, Communication Instrument Booklet B-3283, or Switchboard Instrument Booklet B-3363.

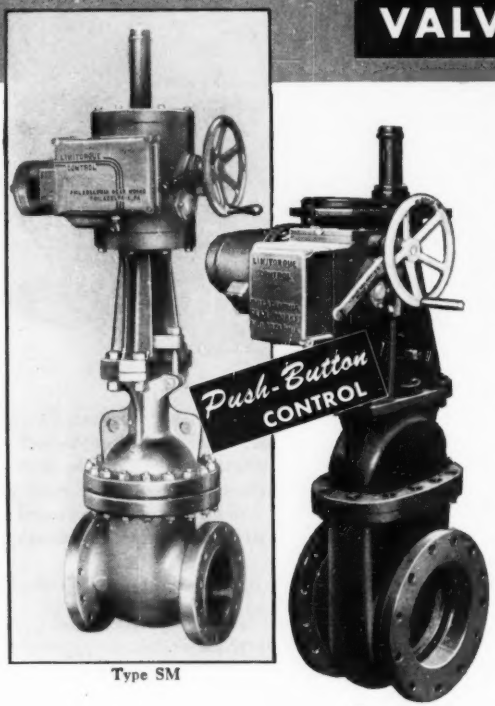
Westinghouse
PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Electrical Measuring Instruments for ANY Job

Positive, Safe and Automatic

VALVE OPERATION

with **LIMITORQUE VALVE CONTROLS**



Type SM

Type GS

LimiTorque is a sensitive, automatic, mechanically actuated device for opening and closing globe, gate, penstock and rotary plug valves; sluice gates; garage, factory and hangar doors; induced and forced damper controls; sprinkler systems; feeder dis-connect switches; watertight bulkhead doors, etc. Most valves are damaged by improper seating, or by meeting some obstruction in closing . . . *LimiTorque control* gives absolute assurance against improper seating, by means of a *positive safety* overload mechanical torque cut-out. If obstruction is met in closing valve, the torque switch becomes operative, and dis-connects the motive power—thus preventing broken gates or discs and damaged stems. Philadelphia *LimiTorque* is the *only* automatic valve operating device that employs this positive principle of operation and control.

LimiTorque, with all its remarkable sensitiveness, is a simple piece of mechanism, containing as few parts as possible. No de-clutching coils are necessary . . . if the current is available at the motor terminal, *LimiTorque* will function regardless of whether valve was last operated manually or electrically. Opening and closing stops are pre-determined to suit application,—and operation may be by push-button, automatic, or manual control.

LimiTorque Controls are designed by engineers who were directly associated with the development of the original mechanical valve operators.

Hundreds of "*LimiTorques*" are used in Central Stations, Power Plants, Refineries, Oil Pipe Lines, Water and Sewerage Plants, on Shipboard, etc.

Send for this 96-page Catalog, and please use your Business Letterhead when writing.

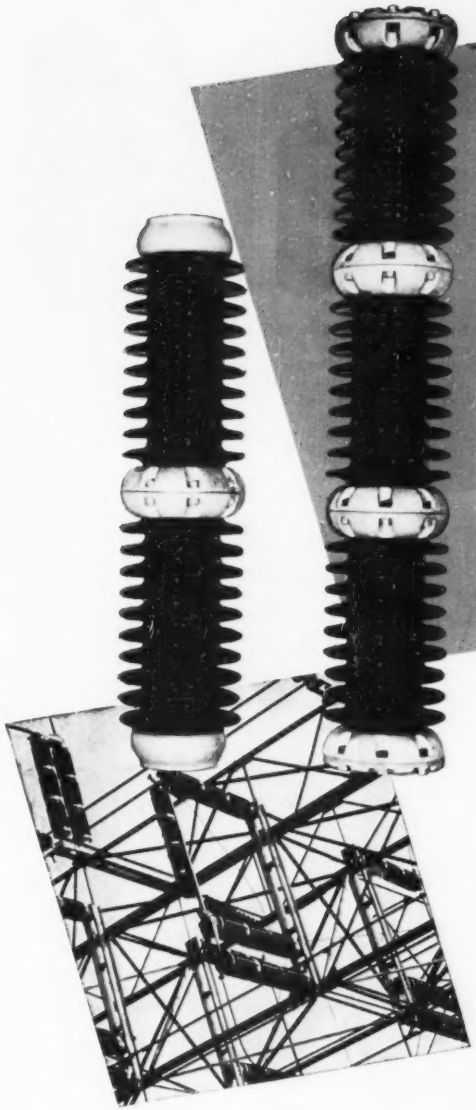
Philadelphia Gear Works, INC.

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.

NEW YORK • PITTSBURGH • CHICAGO

IN CANADA: WILLIAM AND J. G. GREEY LIMITED, TORONTO

Industrial Gears and Speed Reducers
LimiTorque Valve Controls



Mechanical Security
Electrical Security
Long Life . . .

AT VOLTAGES UP TO 161 Kv

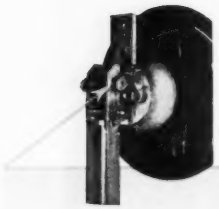
LAPP STATION POSTS

● *It's a matter of record!* The facts-and-figures on 17 years of service of Lapp Post insulators prove that lines and stations on this design have fewer outages, lower maintenance, better performance than lines and stations on any other insulators. It's a difference in engineering concept, a difference in construction—a difference that certainly justifies, for service at all voltages up to 161 Kv, the specification "Lapp Station Posts."

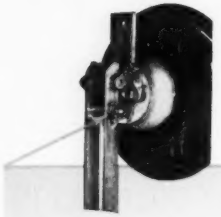
Lapp STATION POSTS

LAPP INSULATOR CO., INC. • LE ROY, N.Y., U. S. A.

new steps to positive switch performance

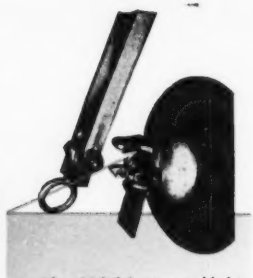


Independently Hinged Blades operate entirely independent of the hinge-end contact. Thus, misalignment which sometimes results from installation can never affect their smooth operation and positive conductivity.

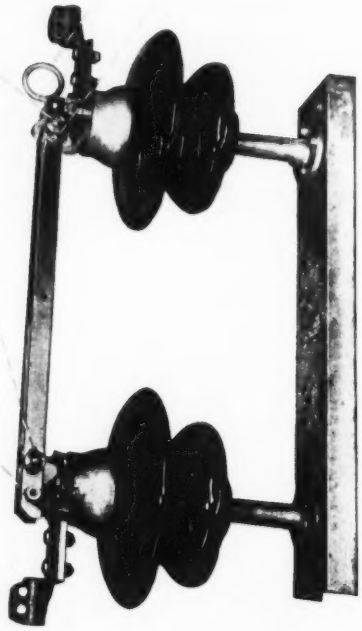


Stainless-Steel Coil-Compression Contact Springs maintain correct contact pressures with no undue wear of the silver contacts.

Pry Off Lock Action assures easy opening under ice conditions and when switch location necessitates a pull with the switch stick almost parallel to the blade.



Silver Nickel Contacts welded to copper on 600 to 2,000 ampere switches . . . your guarantee of permanent conductivity and non-gauling, corrosion-proof performance.



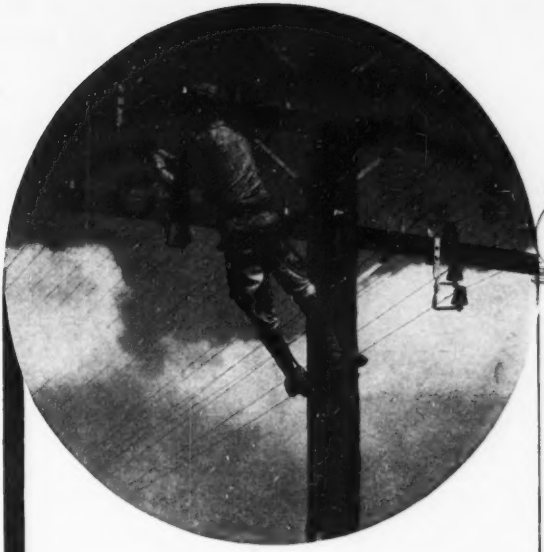
The new Hi-Voltage hook-operated switch with 4 construction features for positive performance

There's a bonus of positive performance for you in this new line of hook-operated switches by Hi-Voltage. Dependable . . . for these disconnects embody new construction features and inherent design characteristics that guarantee *certain operation*, regardless of weather and years of standing idle.

And you can match your requirements to these switches, too. They're made in all capacities from 400 to 2,000 amperes and 7,500 to 115,000 volts. Your local Joslyn Salesman will gladly tell you more facts about this great new model, or write Hi-Voltage Equipment Co., 4000 East 116th Street, Cleveland 5, Ohio.

HI-VOLTAGE EQUIPMENT COMPANY

4000 EAST 116TH STREET • CLEVELAND 5, OHIO



Crossarms, as well as poles, need Penta treatment.

Linemen prefer Penta-clean treatment.

PENTA CHLOROPHENOL preservative

(Monsanto's Santophen 20)

clean, long-lasting protection

Poles and crossarms properly treated with Penta are CLEAN after treatment and STAY CLEAN through years of added life. Linemen prefer to work with Penta-treated poles, since Penta does not bleed—will not rub off and stain hands or clothing.

Penta's high toxicity to wood-rotting fungi, termites and other wood-boring insects means long-lasting protection. Its toxic characteristics are identical year after year because the chemical composition of Penta can always be laboratory-controlled.

The Penta treatment, either by pressure or open-tank method, is simple. . . To learn more about its advantages, send for a copy of a new Monsanto booklet, "PENTA . . . the best protection for poles and crossarms." Address MONSANTO CHEMICAL COMPANY, Desk C, Organic Chemicals Division, 1758 South Second Street, St. Louis 4, Missouri.

Santophen: Reg. U. S. Pat. Off.

PENTA a Non-Conductor—The Penta treatment, which does not increase the conductivity of wood, is also an excellent preservative for platforms, fencing, flooring, roofing and other wood construction.

MONSANTO
CHEMICALS for PLASTICS

MONSANTO CHEMICAL COMPANY
Desk C, Organic Chemicals Division
1758 South Second Street, St. Louis 4, Missouri

Please send me a copy of your new booklet, "PENTA . . . the best protection for poles and crossarms."

Name_____ Title_____

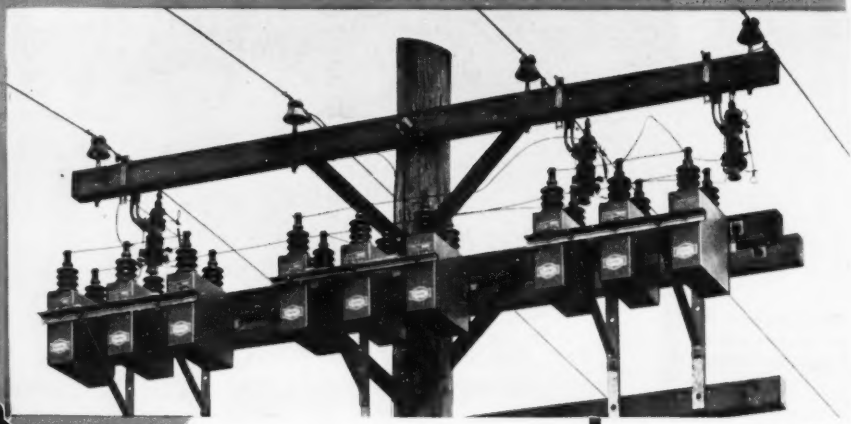
Company _____

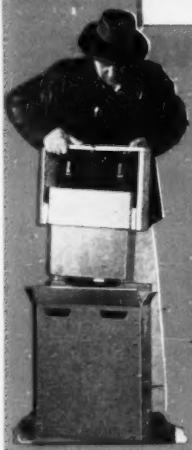
Address _____

City_____ State_____

SERVING INDUSTRY . . . WHICH SERVES MANKIND

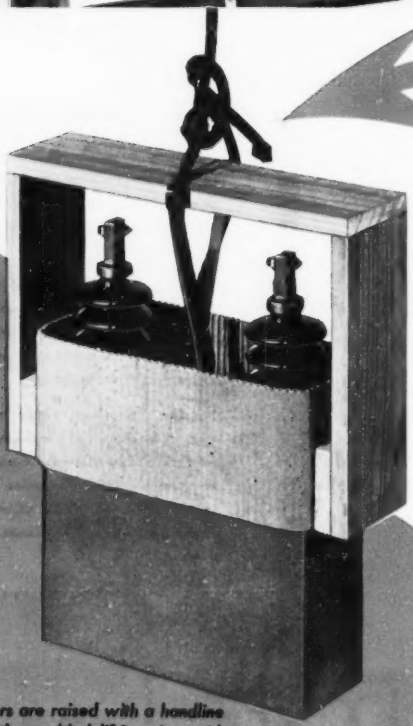
New KEARNEY





In or out of the carton, capacitor bushings are protected against damage. The entire weight of the capacitor is carried by the wood framing.

Hand-holds in the carton are a practical convenience for storekeepers or linemen in handling capacitors.



Capacitors are raised with a handline through the welded lifting ring with the wood framing intact to protect the capacitor against accidental damage.

Shunt Capacitors

For Power Factor Correction

Built by Engineers with Over 15 Years of Capacitor Experience,

Give You These Advantages:

1. **Fit all standard mounting racks**
2. **Extra heavy wet process porcelain bushing**
3. **Welded sheet steel case with hot zinc spray and enamel coating provides double protection to reduce maintenance cost, and—**

4 Exclusive Kearney protective packaging feature

This important feature assures complete protection from the moment of packing until the capacitor is installed in factory-perfect condition on the pole.

Loss of capacitor vacuum through misuse or damage to the bushings by improper handling, is the greatest single factor in causing faulty operation. That's why the Kearney protective wood bar is attached firmly to the capacitor and is of sufficient width and strength to protect the capacitor from the hazards of shipping and installing. The corrugated shipping container, with convenient hand holds, permits easy handling of the capacitor with absolutely no strain on the bushings

In the field the capacitor is lifted from the container by the wood bar handle, then a hand line is attached to the built-in metal lifting ring and the capacitor is lifted into the hanger with the *wood bar protective handle intact.* The removal of the single band from the lifting ring permits easy removal of the wood bar, and the capacitor is safely installed.

Write for bulletin 21-1 for complete information about this improved Shunt Capacitor.

BETTER CONSTRUCTION—SAFER MAINTENANCE

Always Specify KEARNEY PRODUCTS *for the Job*

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO.

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Canadian Plant, Guelph, Ontario

130

UNEQUALLED STRENGTH

THE NEW *Harvel 1012C Insulating Varnish*

The big news in insulation is **HARVEL 1012C** . . . an outstanding development by **IRVINGTON** which provides an insulating varnish with *far greater bonding and cementing qualities than the numerous thermo-setting varnishes tested.* It's a very fast curing resin . . . absolutely oil-proof, and with excellent resistance to moisture and high temperatures. Unequalled for windings operating at high peripheral speeds as well as those subject to great stresses and strains.

Full information and generous test samples of HARVEL 1012C will be furnished on request. Write today.

IRVINGTON *Varnish & Insulator Company*

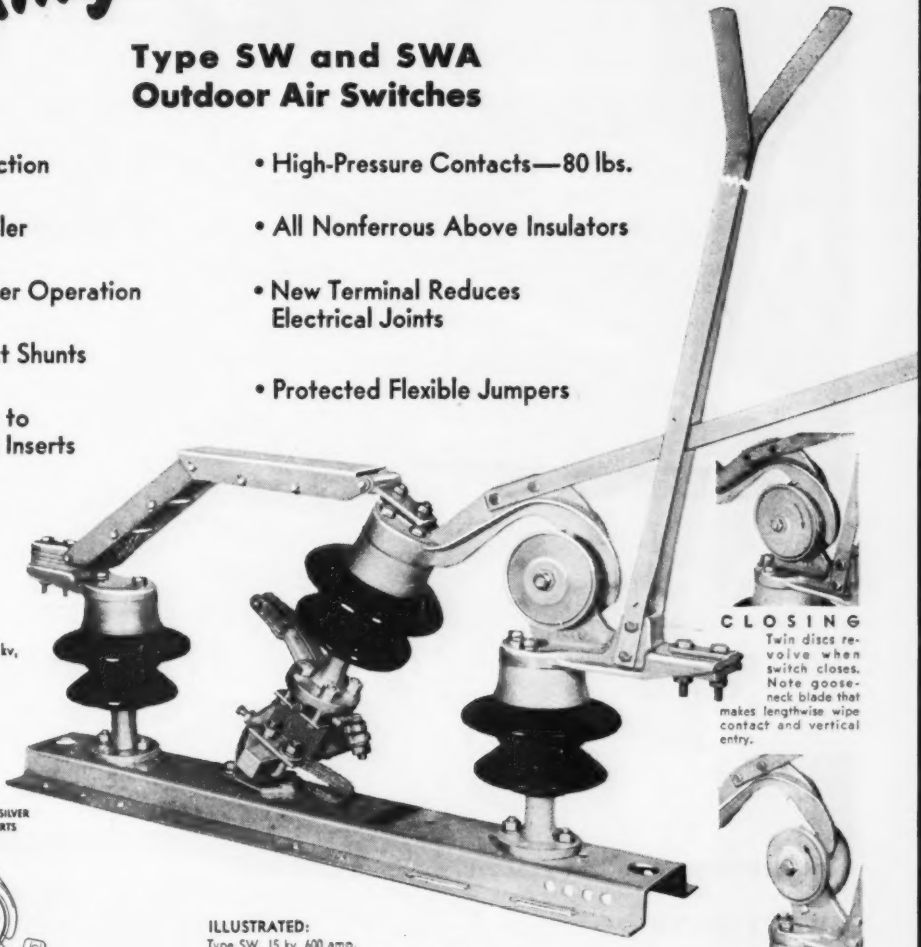
Irvington 11, New Jersey

Now...

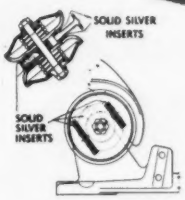
Rolling-Contacts on Rocking-Insulator Switches

Type SW and SWA Outdoor Air Switches

- Reduce Friction
- "Run" Cooler
- Assure Easier Operation
- No Contact Shunts
- Solid-Silver to Solid-Silver Inserts
- High-Pressure Contacts—80 lbs.
- All Nonferrous Above Insulators
- New Terminal Reduces Electrical Joints
- Protected Flexible Jumpers



7.5, 15, 23 and 34.5 kv, 400 and 600 amp; 46 kv, 600 amp.



ILLUSTRATED:
Type SW, 15 kv, 600 amp.
Type SWA is similar, two insulators per pole.

CLOSING
Twin discs revolve when switch closes. Note goose-neck blade that makes lengthwise wipe contact and vertical entry.

OPENING
Twin discs move upward and revolve when switch opens.

Call PACIFIC ELECTRIC MFG. CORPORATION

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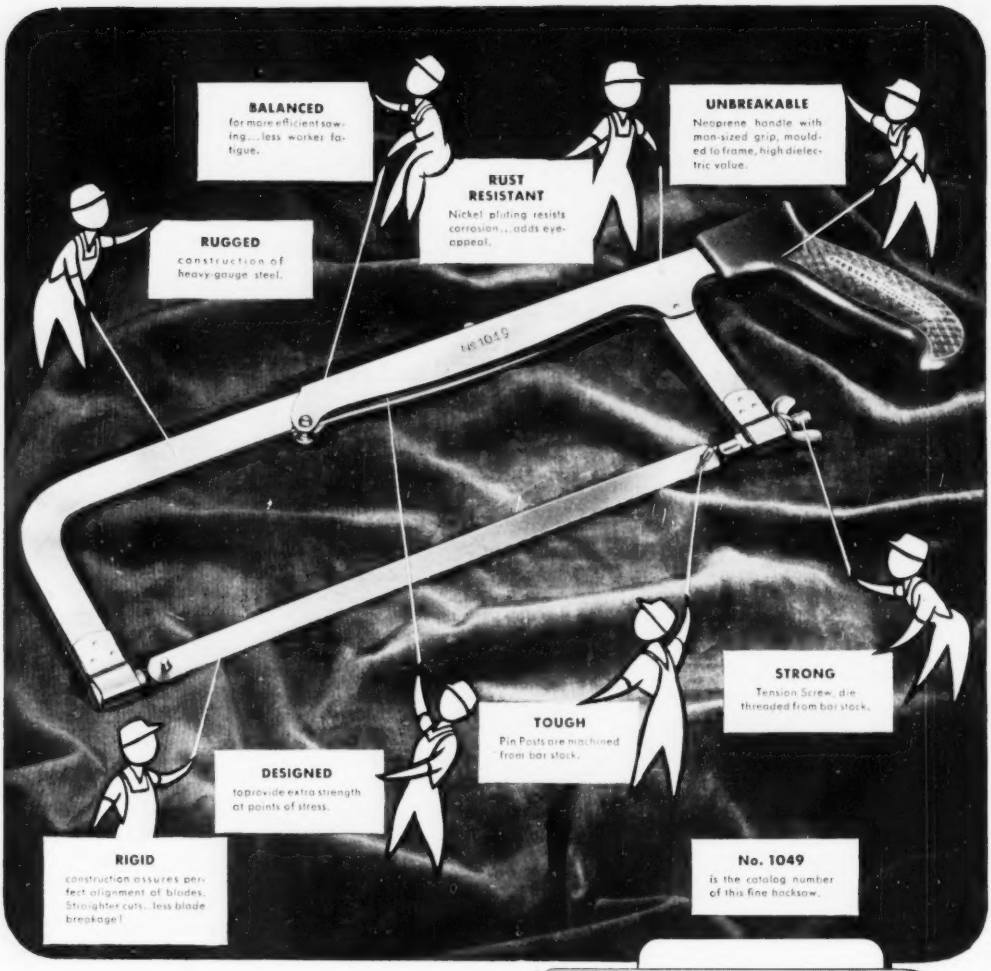
CRAFTSMEN RECOGNIZE QUALITY *by these fine features in a* HACKSAW


BALANCED
for more efficient sawing... less worker fatigue.
RUST RESISTANT
Nickel plating resists corrosion... adds eye-appeal.
UNBREAKABLE
Neoprene handle with man-sized grip, moulded to frame, high dielectric value.
RUGGED
construction of heavy-gauge steel.
No. 1049
STRONG
Tension Screw, die threaded from bar stock.
TOUGH
Pin Posts are machined from bar stock.
DESIGNED
to provide extra strength at points of stress.
RIGID
construction assures perfect alignment of blades. Straighter cuts... less blade breakage!
No. 1049
is the catalog number of this fine hacksaw.

EVERYBODY RECOGNIZES QUALITY *by this Trade-mark*

CRESCENT TOOLS

Sign of the Artisan Symbol of Excellence

"Crescent" is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK

High Interrupting Capacity at Low Cost...

with the NEW HC CUTOUT

PRESTITE PORCELAIN HOUSING—50-ampere, 5-kv—identical for both Type EA and Type HC cutouts.

MOLDARTA TYPE HC DOOR—High strength—high interrupting capacity—interchangeable with Type EA cutout door.

MOLDARTA TYPE EA DOOR—1,200-ampere interrupting capacity.

YOU CAN BE SURE.. IF IT'S Westinghouse

To protect growing systems, the new HC cutout has interrupting capacities of 8,000 amperes at 2,500 volts (4,160 or 4,330 grounded Y), or 5,000 amperes at 5,000 volts (8,300 grounded Y). It is available in two designs, 50-ampere, 5-kv dropout and 50-ampere, 5-kv non-dropout. Doors alone are available for use in existing EA 50-ampere cutouts.

The new HC cutout provides all the advantages of the EA cutout. Doors are interchangeable in the Prestite porcelain housing. All re-fusing operations are done with complete safety by hookstick. A minimum of joints in the current path assures cool operation.

The new HC cutout is available now. For complete information, ask your nearby Westinghouse office or distributor for B-4299. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-60686

Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

PROTECTIVE DEVICES FOR ANY SYSTEM

ONLY Westinghouse gives you this versatility in line protection

WHERE HIGH INTERRUPTING CAPACITY IS NEEDED NOW—install the new Westinghouse HC cutout—either dropout or non-dropout type.

WHERE LINE CAPACITY HAS OUTGROWN CUTOUT RATING—replace the EA cutout *door only* with dropout or non-dropout HC door.

WHERE NORMAL INTERRUPTING CAPACITY IS ADEQUATE—install Westinghouse EA cutouts with assurance that high capacity can be obtained easily and inexpensively when necessary.

DUNCAN

WATTHOUR METERS

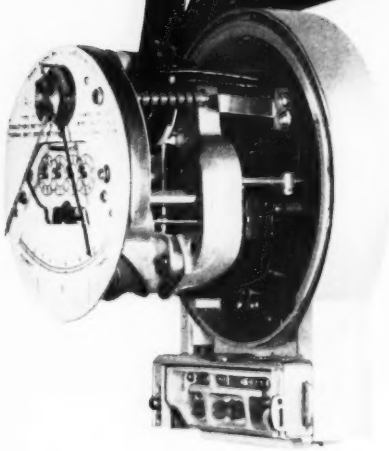
Low Cost

DEMAND MEASUREMENT!

DUNCAN'S Thermal Demand Meter is a reliable, low first cost, low maintenance cost unit—convenient to apply on existing, as well as on new, installations. Thoroughly tested and proved by actual field use, this new product is now available for prompt shipment.

TYPE T-S

DEMAND Thermal METERS



TYPE TF-A

ADVANCED DESIGN. Rugged, high-torque, bi-metallic actuating element is outstanding for simplicity—*demand measurement without gears or timing motors!* Construction makes element readily demountable from meter base, standard watthour meter elements with only minor modification are used.

FRONT ACTION ADJUSTMENTS. All adjustments accessible from front and can be operated with standard screw driver—a design principle pioneered and long practiced by Duncan!

SENSITIVE, ACCURATE. Heat-time response curve corresponds to thermal characteristics of supply systems. Correlation with time-block interval demand measurements permits interchangeability.

MINIMUM DRIVING FORCE NEEDED. Another Duncan "First"! Silicone grease is used to hold maximum pointer in position of maximum demand. This unique material retains practically uniform viscosity from −50° to +400° F.

TYPES. Type T-A and Type T-S Individual Singlephase Indicating Watt Demand Meters. Type TF-A and Type TF-S Combination Singlephase Watthour and Indicating Watt Demand Meters. Sizes: 15- and 50-ampere self-contained; 2.5- and 5-ampere for use with instrument transformers.

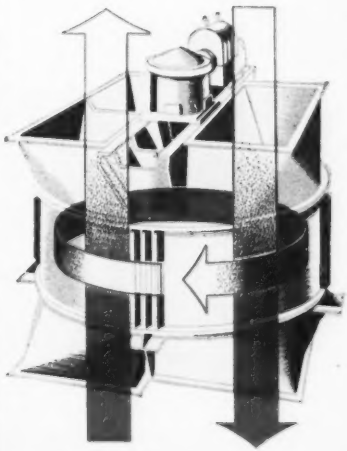
DUNCAN ELECTRIC MFG. CO. • Lafayette • Indiana

Fact File on Preheat

No. 2

In the Ljungstrom Air Preheater, air and flue gases are each uniformly distributed as they flow through the heating surface. This uniform flow through the rotating heating element maintains nearly constant temperatures at any given cross-section. "Cold spots," which often initiate plugging, do not exist at any part of the heat exchange surface.

LJUNGSTROM



The Ljungstrom Air Preheater is a compact gas-to-air or gas-to-gas heat exchanger, operating on a continuous regenerative counterflow basis. Hundreds of power plants and other special applications confirm its high level of heat recovery and long-term service at low maintenance expense.

THE

AIR PREHEATER CORPORATION

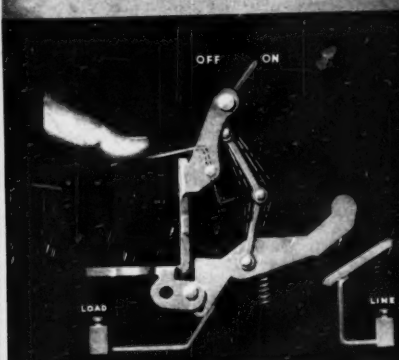
60 EAST 42ND STREET · NEW YORK 17, N. Y.

Plant: Wellsville, N. Y. 960

Here's DEPENDABLE CIRCUIT PROTECTION not AFFECTED BY HEAT...

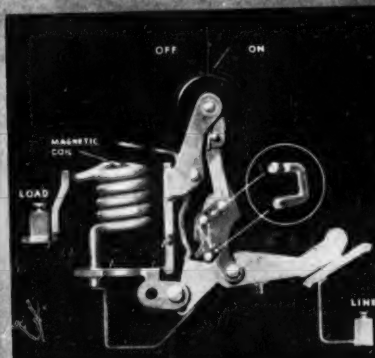
Because the **Murray**

FULLY MAGNETIC Circuit Breaker *Has NO Thermal Element!*



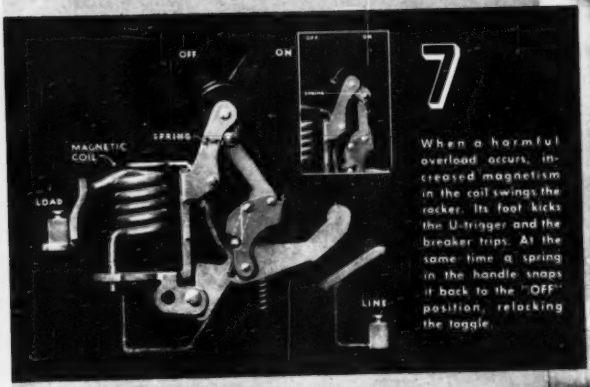
3

In place of a rigid link A, two links are used. Pushing the rocker collapses them and the spring opens the circuit.



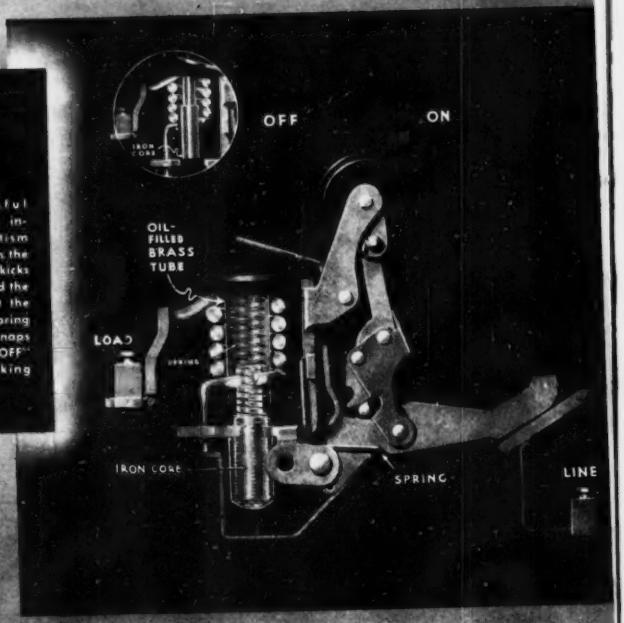
4

Actually a magnetic coil, in series with the load, swings the rocker. For utmost sensitivity, the foot of this rocker kicks a U-shaped trigger which normally locks the linkage into a rigid unit.



7

When a harmful overload occurs, increased magnetism in the coil swings the rocker. Its foot kicks the U-trigger and the breaker trips. At the same time a spring in the handle snaps it back to the "OFF" position, relocking the toggle.



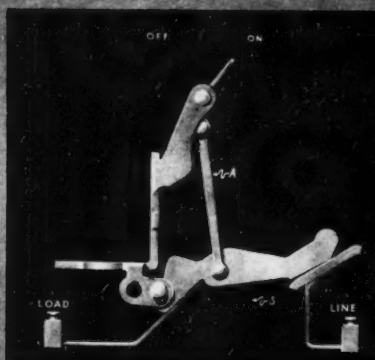
FOR TOMORROW'S LOADS...

Equip Today!

SERVICE ENTRANCE & METER EQUIPMENT • MAGNETIC CIRCUIT BREAKERS • SWITCHES • CURRENT LIMITING

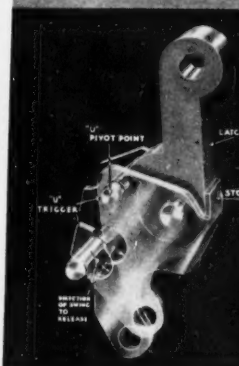
1

No derating is ever necessary when Murray *fully magnetic* breakers protect branch circuits. Hot or cold, these dependable breakers carry rated load indefinitely, tolerate harmless temporary overloads, yet open instantly under short circuits!



2

Basically the Murray *fully magnetic* circuit breaker is an automatic switch. When you push the handle "ON," schematic linkage A closes the circuit and compresses spring S.



5

With the U-shaped trigger in this position, the toggle mechanism is locked into a rigid unit, corresponding to link A in sketch 2 above. The tip of the latch, resting on the edge of the slot in the U-trigger, keeps it from collapsing.

6

When the rocker kicks the U-trigger, it pivots. The slot turns under the tip of the latch and the spring collapses the toggle.

8

To tolerate temporary harmless overloads, the Murray *fully magnetic* circuit breaker employs a movable iron core inside the magnetic coil. This core is immersed in hydraulic fluid sealed in a brass tube. When the breaker carries rated current, the core is below the coil and has little effect on its pull on the rocker. Overload currents pull the core toward the center of the coil, gradually increasing the magnetic field. If the overload persists, the core reaches the end of its travel and increases the magnetic pull on the rocker enough to trip the breaker. Under a short circuit the core is not needed to attract the rocker; the magnetic flux due to the coil alone trips the breaker instantly.

Where Circuits Must Carry Full Rated Load — Plus Harmless Overloads — and Still Be Properly Protected . . .

Insist on the Murray FULLY MAGNETIC CIRCUIT BREAKER

Independent of Temperature.

No derating, no false tripping, in summer sun or in loaded panels.

NO Thermal Element!

UL

Interchangeable Breakers of 10, 15, 20, 25, 30 and 50 Amp. Only Two Handle Positions—Off and On

Murray MANUFACTURING CORPORATION

50 Years of Service to the Electrical Industry

1250 ATLANTIC AVENUE • BROOKLYN 16, NEW YORK

Reprints of this advertisement are available. Write for full details.

...NG REACTORS • CROWS'NEST AERIAL LADDERS

Why we quit making rubber-covered cannon balls

WE have made—and quit making—a lot of things during our nearly 100 years in business. Because of our "know-how" in making insulation of unusual durability, we were asked to develop rubber-covered cannon balls to reduce wear-and-tear on cannon, during the war between the states.

It was an interesting job—but the solution to cannon wear was tougher cannon rather than softer cannon balls.

We have retained our "know-how" in making insulation, however and since those early days, we have made a lot of new developments. We developed the first insulated wire for Samuel Morse's telegraph. We pioneered in submarine cable well before the turn of the century. We even had to develop extruding machinery to apply insulation to wire and cable.

In recent years, Kerite has led in the development of self-supporting aerial cable, high-voltage x-ray cable which no one else could build satisfactorily, and in many other fields.

Kerite insulation—made only by Kerite—provides unusually long life and low cost per year. Why not ask a Kerite engineer to help put it to work for you? *The Kerite Company, 30 Church Street, New York 7, N. Y.*

Offices also at: 122 So. Michigan Avenue, Chicago; 582 Market Street, San Francisco; 714 W. Olympic Blvd., Los Angeles.

Kerite Insulation—Your Cable's Best Life Insurance

KERITE CABLE

Private Enterprise, Feeding on Itself

YOU have recently noticed the drop in electric output to less than 5% over 1948, with two areas showing a small decrease. Funds for expansion are not secured so easily as could be desired, even with the recent market improvements.

Taking this to heart, a number of utility executives reportedly have suggested that deliveries of turbo-generators be delayed beyond the present scheduled date. In proposing this idea they have, perhaps innocently, attempted to set in motion a chain of events that could lead to the "boner of the century." It could result in a failure on the part of the private power industry to provide the necessary reserve generating capacity and a failure to show the leadership essential to the industry's survival.

Certainly it is possible that some utilities may end up with more reserve than necessary in 1951, but surely they can use it to help a struggling neighbor.

This industry needs 6 million kw of new generating capacity every year for the next five, and any steps taken to reduce this annual expansion will be most dangerous.

For example, let us review again the statements made by government officials at the recent meeting of the National Rural Electric Cooperative Association in New York.

Senator Aiken said, in referring to the load estimates of the utilities, "Let no one be lulled into a sense of false security by these musty, moth-eaten mirages of power interests, which never have and never will come true."

John R. Steelman said, "This nation's ability to use electricity has always been underestimated."

Secretary of Interior Krug, said, "Certainly, an essential part of our national power policy should be that our power supply must be sufficient to meet all of the requirements of a full employment economy and provide reserve for all emergencies." In an interview, Secretary Krug made the statement that, under his assumed full employment economy, we would not have by 1960 the 15% reserve which the private power industry predicted we would have by 1951.

One may discount these statements as political or promotional, but one cannot ignore them and the extent to which similar ideas have penetrated the thinking in Washington.

The most foolish thing the industry could do today would be to underestimate the future expansion in electric consumption. Few months are left for placement of orders permitting capacity additions in 1951. A review now of the capacity needs of 1951 and thereafter will not only insure adequate reserve for the individual utility but will also protect the industry against political attack on this score.

It would be most astute to forget the minor fluctuations in business today and think in terms of the television, house heating and cooling, clothes dryer, water heater, commercial lighting and air conditioning, and industrial applications that will or can be sold in the next five years to assure full use of 6 million kw additional capacity every year.

From Task Force to "Ho Hum" File

"INCOMPARABLY the greatest opportunity for economy lies in the imposition of precautions to eliminate wasteful water development, and to assure soundness of the projects finally adopted. In the past, projects have been carried through which should never have been undertaken at all. Others have been wastefully constructed, and without regard to important potential uses. Still others have been premature. Bad accounting methods have consistently underestimated costs. Inadequate basic data, inter-agency competition, and local political pressures bear the primary responsibility for this extravagance and waste. If the measures hereinafter proposed by the committee for obtaining more adequate basic data, for a central review agency, and for elimination of inter-agency competition through consolidation are adopted, savings running into the billions during the next decade or two would appear assured."

Now that you've read this far, read that first paragraph again. Read it carefully, savoring the two-fisted words with which it is studded. Be sure you grasp precisely what it says. It's important.

You see, here's a criticism of government which comes not from the "power trust" or from the "expensive lobby of a selfish vested interest." What you've just read comes from a group of government-paid investigators reporting their findings in an investigation of government programs. Specifically, it comes from Page 3 of the Natural Resources Task Force Report to the Hoover Commission.

You'd think, on reading as harsh a criticism as this, that the people who have U.S. resource development at heart would be pretty perturbed. You'd think both Cap Krug and Leland Olds, both of whom have long and loudly been described not as enemies of the power business but rather as apostles of conservation, would want to know whether this criticism is justified, and, if it is, would work hard for correction of a condition that threatens the effectiveness and the life of resource development work. You'd think their crusade, if it be that, would take them into the lists to fight such waste.

Perhaps they will. Certainly, we hope so. But we think this report is going straight into Washington's "ho hum" file, and that the tax savings it envisions are going straight into some administrative agency's budget, to be spent the same old way.

Water Heating Load Characteristics

CONTROLLED domestic water heating has established a firm place in the loads of most utilities in this country. Expansion is now particularly rapid in rural areas, including those served by electric co-ops. In fact many co-ops are now being faced with the problem of adequately controlling water heater loads as the saturation increases.

A substantial amount of test data is already available on the load characteristics of water heaters, obtained from load tests and the study of area load curves. For practical purposes these are adequate to determine the peak period control of water heaters. But there are many cases in which the low saturation of water heaters makes control uneconomical and others in which the true characteristics of the water heater load are not known.

Would it not be logical to take one or two new areas and run tests to prove the necessity of control? Such tests could easily be made by placing carrier current control on the area. With this device the water heater load could be checked for each 15 or 30-minute interval during the day. In this way the exact load characteristics of the heaters can be determined for each day of the week. Such data would prove invaluable in setting schedules for water heater control and evaluating the rates necessary to provide an adequate return.

Important Public Information

ONE RULE of thumb observation about electric utilities as employers is that you don't get paid too well, but the work is steady. Thanks to the Bureau of Labor Statistics, the refutation of at least part of this ancient belief is at hand.

According to a BLS December monthly "hours and earnings" report, it is apparent that the wages of plant workers average higher in the power business than they do in manufacturing industries. Straight-time wage rates paid by utilities to plant workers, according to the BLS findings, average $1.50 per hr. In manufacturing industries, the comparable rate is $1.37. That's a 9.5% difference. It is quite impressive when it's coupled with the well-known stability of employment which electric utility work offers. And it becomes even more attractive when the benefits which are so common among utilities are thought of—the insurance and pension plans, sick leaves, vacations, and holidays with pay.

This BLS report is what we'd call live news for the men in electric utilities who are spending an increasing amount of time on the promotion of employee relations. It certainly is a favorable story and it comes from a source which the unions regard as being entirely official. Aside from the employees, we'd guess that the stockholders would find it of great interest to learn that the companies in which they've invested are at the head of the parade. For one of the greatest threats today to the industry is the labor dispute. This is true whether it takes its effect in a strike, a slowdown, bad worker morale, or however.

Yes, individual systems may choose to make known the fact that the industry is out in front on wage rates. We'd guess this is one part of a public information program to which even the most reluctant operating utility executive could agree.

The Electrical Week

Eleven months after Britain nationalized its electric power industry, it is apparent that the switchover has been smoothly accomplished. The system is operating as well as ever, but personnel is slowly acquiring the civil-servant attitude . . . At Chicago, the National Electrical Manufacturers Association held its winter meeting, and speakers stressed not only that an understanding of the industry's economic and service problems is necessary but also that the manufacturers must do something about them . . . Revisions have been made in the "advance payment schedule" and "overall commitments clause" of the contract for ACSR between Wisconsin Electric Cooperative and Reynolds Metals Co. Advance payments will not be due until May 14, and the amount of ACSR ordered will be on a variable rather than a firm basis . . . Congress believes that construction costs are coming down; so the House Appropriations Committee is considering slashing all federal construction funds a flat 15% for fiscal 1950. The first agency to be affected would be the Interior Department.

Attorneys in Washington assert the bill recently passed by the state legislature permitting two or more PUD's to combine in acquiring the properties of a private utility is unconstitutional. It's claimed that the bill—which also sets up a state power commission and provides that PUDs make "in lieu" payments to school districts with bond indebtedness—violates a provision of the state constitution that no law may cover more than one subject.

Twelve members of the 19-man utilities committee of the Chicago Bar Association have resigned. Their object: To protest the Association's refusal to support legislation that would divide judicial and prosecution functions of the Illinois Commerce Commission.

The New England Council has offered a reward of $100 to any person presenting facts and figures proving that the cost of power was the primary reason for any industry's leaving New England within the last three years.

EEI's latest tabulations of capacity increases by private and governmental systems show that through 1951 additions now scheduled will not alter materially the existing "80% private, 20% government" ratio in central station capacity. As expansion is now projected, private systems will add 132,000 kw, less than four times as much capacity as governmental systems in 1949. In both 1950 and 1951 private companies will add 500,000 kw, more than four times the government installations.

Potato sacks have no place in transformers even if ELECTRICAL WORLD *does publicize them (Feb 26, p 54). They definitely will not be made standard equipment, an industry committee ruled last week.*

The first atomic bomb was exploded at White Sands, N. M., in 1945. A demonstration at the show held in connection with the Institute of Radio Engineers' annual convention proved that the fused sands are still radioactive.

A world's record is being claimed for the installation of a 60,000-kw turbo-generator in the Hutching's Plant of Dayton Power & Light Co at Miamisburg, Ohio. The GE unit was installed and hooked up to transmission lines in 27 days. The former record is supposed to have been 47 days for a unit installed in a plant of the Pacific Gas & Electric Co.

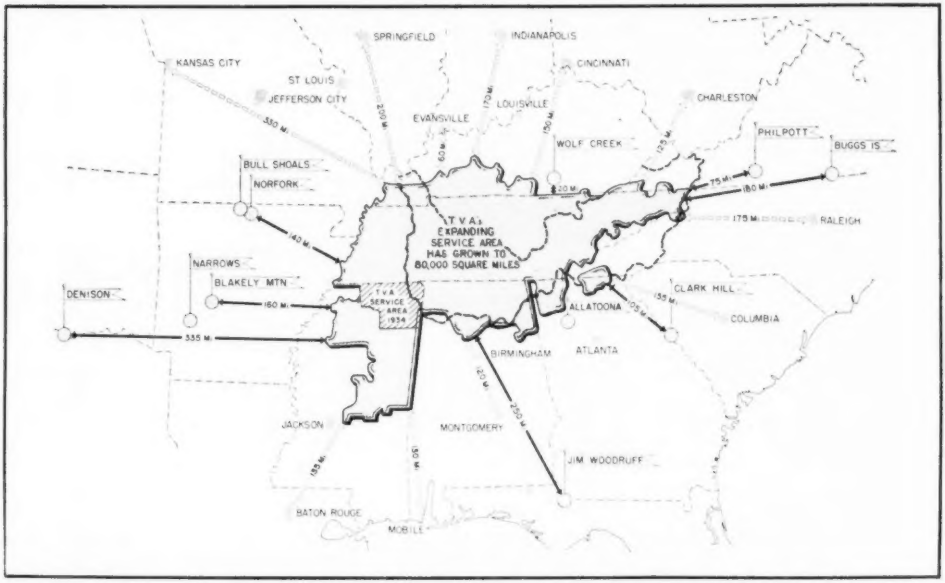
A new power subsidy, limited to Alaska, is proposed as a means of developing the territory. It comes in an Alaskan development bill (HR 224) and would permit the Federal Works Administrator to build power facilities that would be bought by public bodies at prices not less than 25% or more than 75% of the estimated cost to the federal government. The same terms apply to other public works such as schools, roads, etc.

Industrial leaders supporting the Holyoke Water Power Co in its battle with the Holyoke (Mass.) municipal electrical department to get FPC authority to develop the Connecticut River assert that scrapping the century-old canal system would jeopardize the paper-making plants of the city.

Notes From The News

Georgia Power Co has lifted all restrictions on the use of industrial power which were established last August . . . Long Island Lighting Co and its subsidiary, Nassau & Suffolk Lighting Co, have received permission from the New York PSC to establish bimonthly billing . . . Governor Warren of Florida has asked all state employees to aid the state financially by using electricity frugally . . . During the 1937 Ohio River flood, street lights in Smithland, Ky., were de-

Continued on following page



TVA SERVICE AREA and its relation to neighboring cities and federal power projects in existence and under construction

stroyed. This month 18 new lights were installed . . . Montana Power Co has been granted a FPC license for its existing Thompson Falls hydroelectric project on the Clark Fork of the Columbia River . . . Fire which spread from a locker room for workmen destroyed $25,000 worth of equipment at a warehouse of the Rochester Gas & Electric Corp in that city . . . With state police on duty to protect them, Pennsylvania Power & Light Co construction crews strung a high-tension power line in Gilbert, Pa. The utility had to secure an injunction after the property owner had threatened the crews with a shotgun . . . The Shamrock Hotel, Houston, Tex., has 262 complete General Electric kitchens. Each apartment kitchen contains a refrigerator, range, stainless-steel sink, all-steel cabinets, and a Disposall.

Construction:

The Illinois Power Co has been taking options on land in the vicinity of Hennepin for the erection of a generating plant . . . Florida Power & Light Co has been offered a free site for a power plant at Palatka by the Palatka Pulp Mill Syndicate, Inc . . . Georgia Power Co has just put into operation a second 22,500-kw unit at its Plant Mitchell, ten miles south of Albany.

Legislation:

The Massachusetts Department of Public Utilities would be required to hold public hearings on proposed rate increases in the area which would be affected under a bill reported favorably by a committee of the Legislature. . . . The Arizona Senate has passed a measure which provides that if a private utility does not serve an area after an application for service has been made a co-op may then enter the territory. . . . Indiana's Compulsory Utility Arbitration Act, passed in 1947, will stay on the books at least another two years. The Legislature has adjourned without passing a substitute voluntary arbitration plan proposed by the governor. . . . Florida legislators are divided on a proposal to put electric and gas utilities under state regulation. . . . A bill providing for power rationing by the state during periods of emergency was killed as being unconstitutional.

Financial:

A $1,226,000 financing program for the Tucson Gas, Electric Light & Power Co has been approved by the Arizona Corporation Commission. . . . Consolidated Edison Co has filed with the New York Public Service Commission a petition for authority to issue $12 million in 30-year general mortgage bonds on the properties of Westchester Lighting Co. . . . Stockholders of Detroit Edison Co have voted to increase the company's authorized capital stock from ten million to 15 million shares. The new stock will not be issued until needed to finance the construction program. . . . Indianapolis Power & Light Co has increased its quarterly dividend on common stock from the 37.5 previously paid to 40c a share.

British Power Takeover Smooth

Eleven Months of Nationalization Bring Few Changes but Reduce Freedom, Promote Civil Servant Psychology; Mild Winter Prevents Operating Tests

[This story is a condensation of a report by Fred Brewster, London correspondent of the McGraw-Hill World News—Editor]

ELEVEN MONTHS after the fact, it is apparent that Britain's switchover to nationalized electric power has taken place smoothly. That's no mean achievement, in view of the open hostility that was displayed by private systems and the misgivings with which most municipals viewed the program. Credit generally is accorded Lord Citrine, chairman of the British Electricity Authority.

Wage Boosts Postponed

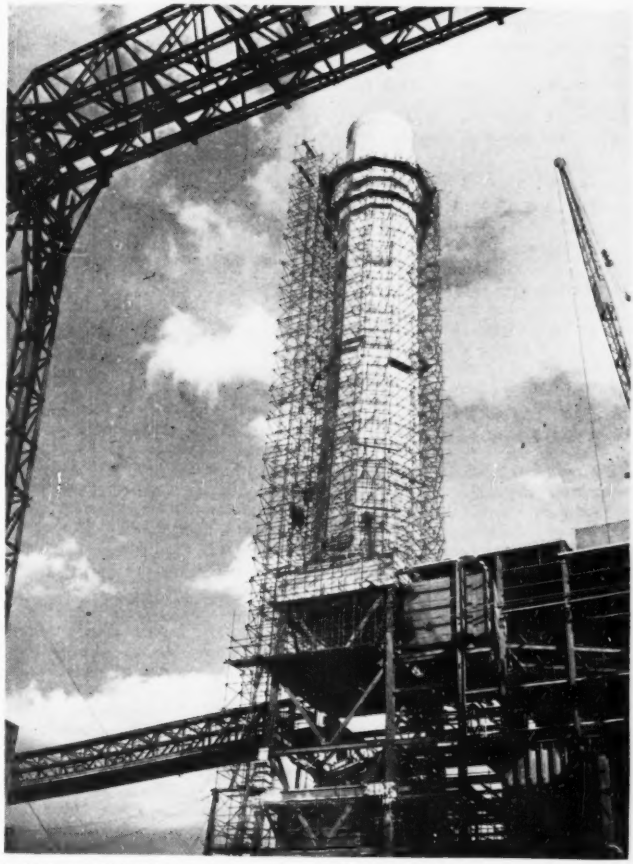
Rather than labor trouble, there has been perhaps too much jubilation on the part of employees. BEA has been inclined to squelch their over-eager assumptions. And BEA has made its point stick—that wholesale wage boosts must wait, at least until after the first annual report, which won't be out before September.

In general, operation and management of major generating stations, the Grid, and local distribution systems remain in the same hands. Particularly in nationalized municipal systems electric operations were so bound up with local government that they could not immediately be pried loose. And nationalization is still so new that whatever tradition of private enterprise existed before April 1, 1948, still remains.

Civil Servants Created

First impressions, however, indicate that even 11 months is long enough to convert many an energetic technical man, say a power station engineer, into a civil servant. For example, where formerly he could be approached by anyone, now he has acquired a battery of secretaries and assistants to bar his door.

Moreover, although under nationalization he may have gained in security he certainly has lost his freedom. Previously, if his wife's health happened to call for a move from Yorkshire to the South Coast, he could put out feelers for a job with, say, the Eastbourne electricity supplier. Now, however, all his potential employers are part of one vast organization. Transfers such as he wants would call for endless formalities. And with only a single employer (in effect) to work for in Britain, he can't afford to snap his fingers at a boss he didn't care to work for, in the carefree way he formerly could have.



ONE OF ENGLAND'S newest power plants will be that at Deptford Green

Critics of nationalization don't believe it will last, but thus far BEA hasn't been troubled by fraud or mismanagement. One official of an area board has resigned under charges. But the inquiry did not reflect upon his conduct on the area board.

So far BEA has faced no severe operating tests—it's been a mild winter. Load shedding has been continued, of course—peaks threatened to be 2 million kw above capacity. Coal stocks, subject to government allocation, are below the traditional three-month margin, standing now at slightly more than five weeks.

Despite the fact that capacity won't catch up to demand at least until 1952, generation was at record heights last year. Output, including 1.2 billion kwhr from the north of Scotland, reached almost 46.5 billion kwhr, nearly 4 billion above 1947. Installed capacity stood last December at 12,752,000 kw, with two new plants put into operation during the year. This winter all customers have been required to cut consumption 20%. Particular attention was

asked to the lowering of consumption on peak.

To get at the latter problem, residential rates were raised half a cent per kwhr for the winter quarter. There'll be a compensating refund during the subsequent nine months—BEA just wants to keep appliances, particularly "fires," off the peak. So far the device hasn't shown any great reduction in peak loads, whatever its effect may be upon the kwhr totals. Most people doubt that there'll be much saving from it.

Rate Picture Confused

Ratewise, the picture since Vesting Day (April 1, 1948) is confused. Soon after the take-over, rate increases averaging 20% were instituted for residential and commercial customers in about 150 areas. These had been okayed for existing suppliers before the nationalization and were required to avoid or limit a loss. The aggregate increase was expected to wipe out most, if not all, of an estimated $28 million deficit these areas otherwise would have faced in 1948-49.

Second Rate Boost Made

The second rate boost—and the first to be truly chargeable to BEA—was authorized in August. It resulted from coal cost and wage increases. All area boards not already charging that much were permitted to increase two-part, multiple, block, or flat-rate tariffs to a minimum of 1.25¢ per kwhr. It was explained as the first step in standardizing all BEA unit charges. The increase was expected to yield about $4 million for the financial year ending this month, about $8 million in the full year following. Some rates were cut, from 20 to 10¢ per kwhr. Average revenue per domestic kwhr in 1946-47 remained below that of 1938-39.

Financing Not Affected

Financially, nationalization hasn't hurt bond prices or sales. The first issue, made to compensate for expropriated holdings, is quoted at 103½. A second issue—for financing new plant—was offered at 99.5 and was generously oversubscribed. It stands now at 101.75. Both are 3% issues, government-guaranteed.

As yet manufacturers of power equipment haven't seen much difference either. The old Central Electricity Board controlled new generation for so long that the transfer hasn't worked much change. Existing contracts were continued. For new contracts, the manufacturers may have easier sailing. Now there's only one purchaser of generating equipment (BEA) and only 14 buyers of distribution equipment (the area boards). Formerly there were 541 systems, 362 of them municipal.

LORD CITRINE

In 1947 CEB had standardized on two sizes of generating equipment (30,000 kw and 60,000 kw) for installation in Great Britain. There had been moves toward transformer standardization, and last October the Minister of Supply organized a committee to study standardization of engineering components, many of which would affect power.

Centralized Buying Seen

But the way is seen clearly toward more centralized buying. Already there has been considerable lessening of direct contact between suppliers and local operating people. While no restrictions on manufacturers have come from nationalization, the government—through its appeal for a voluntary "stand-still" on dividends—has curtailed profits. The British Electrical and Allied Manufacturers' Association still regularizes prices, without protest so far from BEA. But BEA holds a considerable interest in BEAMA firms, acquired in the Vesting. So it possesses the nucleus of a manufacturing operation that it might choose to use one day.

Production of generating equipment has been crowding the maximum of 1.2 million kw yearly. BEA took 800,000 kw of this in 1948, may take 1 million kw this year. Construction of power houses has lagged behind availability of equipment. The program calls for 1 million kw to be added in 1949; 1.15 million kw in 1950; 1.5 million in 1951; and 1.6 million in 1952. Installation rates are below schedule but well above prewar totals.

Wildcat Strike Reduces Output at Venice Plant

A wildcat sitdown strike of operating personnel at the Venice (Ill.) No. 2 Plant of the Union Electric Co of Missouri last week seriously curtailed electric service in the St. Louis area for 4½ hours. The men involved are members of Operating Engineers' Local 148, AFL. The strike was in sympathy with other members of the local who are involved in a jurisdictional fight with a rival CIO union at the Shrewsbury Plant of the Laclede Gas Light Co. There is no connection between the utilities.

First indication of the trouble came at 9:30 pm Mar 15, when the dispatcher at St. Louis noticed that output from the Venice Plant was dropping sharply. He notified company officials. They were unsuccessful in reaching union leaders, and the 250,000 kw output dwindled away to practically nothing at 11 pm when plant shifts change. The next shift refused to go to work but stayed at the plant.

At 12:30 am Union Electric executives notified Clifton A. Bowler, president of the local, of the stoppage. He immediately called the union steward at the Venice Plant and ordered an end to the strike. Normal operations were resumed by 2 am. So far as company officials could learn, the Wagner Electric Corp was the only industrial customer affected.

The trouble at the Laclede Gas plant arose following an NLRB-conducted bargaining election. The AFL local lost. Some 200 members were given the choice of either joining the victorious CIO unit or else losing their jobs. The AFL union officials had advised the men to join the CIO, but most of the men refused and started picketing and demonstrating at the plant.

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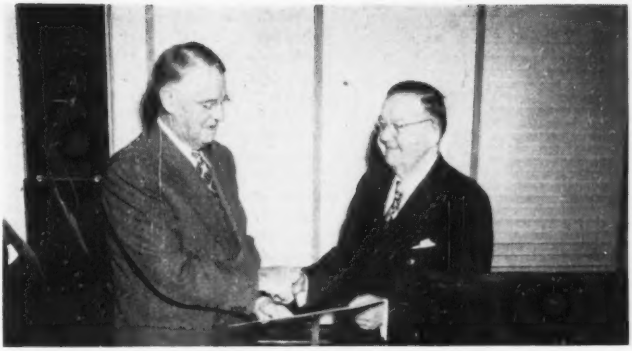
Farm Lighting Booklet Now Available from EEI

"Light for Seeing on the Farm," an educational and promotional booklet that shows farmers how good light can help increase farm production, reduce chore time, prevent accidents, and perform many other tasks, is now available.

It is a part of the Planned Lighting Program, which is sponsored by Edison Electric Institute and the Better Light Better Sight Bureau. The 16-page booklet is printed in two colors and is amply illustrated. Copies may be obtained from Edison Electric Institute, 420 Lexington Ave, New York 17, N. Y. The cost is $10 per hundred in quanties below 1,000.



REX T. STAFFORD, right, receives 50-year gold certificate from NEMA President B. W. Clark for his service to industry. Presentation was made at NEMA meeting in Chicago

Importance of Acting on Industry's Problems Stressed at NEMA Meeting

WE CANNOT afford not to understand the industry's economic and service problems better, and we cannot afford not to do something about them. That basic thought was expanded at the National Electrical Manufacturers Association winter meeting in Chicago last week by the three main speakers—Emerson P. Schmidt, director of economic research, U. S. Chamber of Commerce; J. W. McAfee, president, Union Electric Co. of Missouri; and Carl H. Christine, secretary-manager, St. Louis Board of Trade.

A free market must be maintained if we are to preserve our American way of life, Schmidt emphasized. In the recent past and in the future government has been and will be the big factor in this sphere with which we must contend. "From now on, we are likely to have a 'labor' government. If not in name, it will be in fact. This is true of the federal government and is likely to be largely true at state and local levels. This trend will experience occasional but short-lived setbacks. Organized labor is likely to be a dominant political force from now on. There is nothing in sight to stop this trend, indeed, it is likely to be accelerated.

"If so, we must learn to live with it. We must learn to adapt ourselves and our thinking and our economic structure to this new situation. It means some very fundamental changes in the years ahead, changes which will not strengthen our economy, if precedents in other lands are any guide. Does this mean socialism? Probably, but not in the short-run."

To retard this, he said, we as individuals could help take the pressure off Washington and help perpetuate our freedom and economic progress longer by:

1. Conducting business affairs so that all basis for legitimate criticism is removed.

2. Supporting a sound fiscal and monetary policy so as to remove the necessary elbow room which over-all planners must have in order to convert our society into an authoritarian system.

3. Stepping up educational systems but not supporting through foundations or otherwise the projects or people whose aims or whose policies and actions will destroy our freedom.

4. Obtaining a better understanding of how our economy has functioned in the past and what it takes to keep it operating in the interests of all the people in the future.

Our ability to stay in business depends upon our ability to sell ourselves to the community as well as our ability to sell power to the customers, McAfee stated. We must find a way of getting our story to the man in the street.

"To sell more power we must get behind the National Adequate Wiring Bureau stronger than ever before. The wiring problem is one of the biggest deterents to the sale of appliances and power. We have done well but we must do better, and we, in St. Louis, are trying to do just that", he concluded.

Christine gave a dramatic demonstration of good wiring's effectiveness. We must dramatize good wiring, discuss it in non-technical language if we expect people to understand why, with an inadequate wiring job, a perfectly good percolator will not percolate perfectly, why an all-right iron doesn't iron all right, and why a satisfactory vacuum cleaner doesn't satisfy, he concluded.

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More Research Needed to Popularize Heat Pump

While varying degrees of success have been obtained with the use of the heat pump, belief is that considerable additional research is needed to bring this power load equipment into wide public acceptance and use.

This is the consensus of those attending a meeting of the Heat Pump Steering Committee of the Southeastern Electric Exchange and of the technical subcommittee of the Joint Heat Pump Committee of the Association of Edison Illuminating Companies and the Edison Electric Institute. The committees met recently as the guests of the Alabama Power Co.

It was agreed that in mild climates the heat pump which extracts heat from the air is most desirable. In colder areas, the type which extracts heat from wells, streams, lakes, or the ground is preferable.

Alabama Power has installed the first commercial heat pump in the state. It draws heat from the air, and satisfactory results have been obtained.

Members of the Southern Research Institute, who have been experimenting with the heat pump for three years, related results of installations in the Southeastern region. Architects are specifying heat pump installations in commercial establishments rather than separate installations for winter heating and summer cooling.

Home installations in the Southeast have been increasing. One large Atlanta installation is providing useful operating data.

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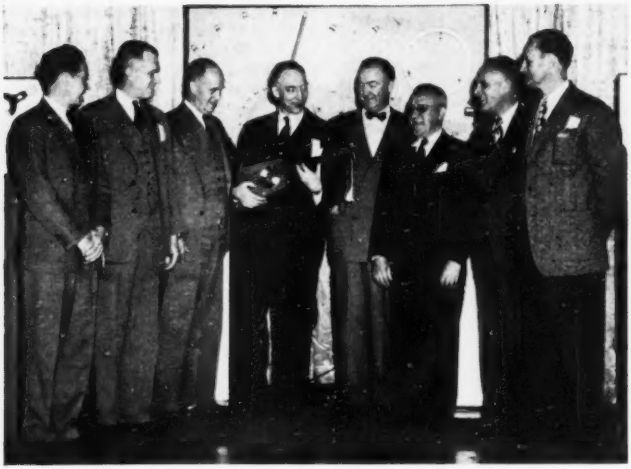
Water Outlook Bright

Lake Mead, behind Hoover Dam, is expected to rise 48 ft by August as a result of a 11,900,000 acre-ft. spring runoff, the largest flow into the lake since 1941. The runoff last year was 9,491,000 acre-ft. If the forecast is correct, the lake will rise to within 7 ft of the spillway crest at Hoover Dam. Power generation at the power plant has been stepped up in order to lower the reservoir and make room for the above normal runoff and thus prevent wastage of water through non-power releases. Improved water conditions have been noted elsewhere in the Southwest.



"UKE-LIGHT-LE," a novel musical instrument whose sound is produced from light rays, is demonstrated at a recent conference on Lighting Application. The conference was conducted by the New York Power & Light Corp, Albany, for lighting men, architects, and consulting engineers. Left to right are C. J. Allen, Nela Park; C. D. Hollister, NYP&L lighting advisor and chairman of the EEI Commercial Lighting Committee; R. P. Wagner, NYP&L commercial manager and chairman of the Executive Committee of the Better Light Better Sight Bureau; Alston Rodgers, Nela Park, doing the demonstrating; F. T. McEvoy, NYP&L vice-president; Dr Matthew Luckiesh and W. M. Potter, Nela Park; and D. M. Warren, General Electric

Changes Made in Advance Payments, Commitments of Reynolds-WEC Deal

REVISIONS have been made in the "advance payment schedule" and "overall commitments clause" of the eight-year cable-supply contract between Wisconsin Electric Cooperative and Reynolds Metals Co.

Under the new terms of the joint contract—announced two months ago by the National Rural Electric Cooperative Association as a means of breaking the conductor bottleneck which was restricting the construction activities of REA-financed cooperatives — advance payments to Reynolds will become due May 14, rather than March 14, April 14, and May 14. And the total will range upward from a minimum of $4 million rather than the flat $6 million originally called for. Final effectuation of the contract depends on the co-ops' meeting the required advance payments.

W. V. Thomas, general manager of WEC, told an ELECTRICAL WORLD correspondent that, on the basis of conductor orders received so far, Reynolds is assured that the program will be a success. But Thomas declined to be more specific.

WEC, it has been known for some weeks, is doing an intensive selling job to assure the signing of enough contracts to guarantee that the eight-year conductor supply program will become effective. But specific statements as to the amount of conductor for which firm orders had been given were unavailable.

From another source ELECTRICAL WORLD learned that on March 14 the following "commitments" had been made:

1. Ten million pounds covered by advance payments, which had then been made.

2. Twenty-nine million pounds in signed contracts for which no advance payments had been made at that time because of administrative and processing delays.

On this basis, Reynolds would have received, by March 14, $300,000 in advance payments—at 3¢ per lb for Reynolds, 1¢ for WEC—and would seem to have another $870,000 pretty solidly assured, awaiting only completion of the processing by WEC and the Rural Electrification Administration. REA must approve all contracts.

Again on this basis, there would have been insufficient advance payments on hand to meet the first advance payment deadline of the original contract. The original schedule called for $1 million last week, $1.5 million by April 14, and $3.5 million May 14.

Another revision of the original contract changed the amounts of cable to be taken yearly by WEC for distribution co-ops. Originally, WEC was to have received 50 million lb of ACSR between Feb 1, 1950 and Feb 1, 1951; 75 million lb during 1951–52; 100 million lb during 1952–53. Thereafter deliveries were to have been 50 million lb yearly through Feb 1, 1958. All this was to have been firmly under contract. For the six years after Feb 1, 1958, up to 40 million lb yearly was to have been available to WEC but not firmly under contract.

Firm Demand Changed

Under the revised contract, a minimum of 50 million and a maximum of 75 million lb of ACSR yearly are to be contracted for during each of the eight years ending Feb 1, 1958. That substitutes a variable total for the contract ranging from 400 million to 600 million lb under firm contract. Under the original, 475 million lb was to have been under firm contract.

Wherever they buy it, one source asserted, co-ops are having a good deal less difficulty with conductor today than they experienced a few months ago. The Reynolds-WEC contract is an important factor in this supply improvement, this source said.

Deliveries to Begin in April

Reynolds will begin deliveries of ACSR in April, this source declared. With interim power assured for a third potline at Jones Mills, Ark., Reynolds has been diverting some ingot from other uses to ACSR production by toll fabricators. This metal will be "repaid" when the third Jones Mills potline begins operation soon. But the diversion will advance the date of the first ACSR deliveries from Reynolds.

At Chicago last week, gossip around the NEMA convention was that some cable manufacturers were planning to cancel all existing orders for cable that have been placed by co-ops which sign contracts to take their needs of the next eight years from Reynolds. Under REA's approval of the Reynolds-WEC agreement originally, co-ops were to obtain from Reynolds between next Feb 1 and Feb 1, 1953, all conductor needs not already contracted for, and all of their conductor needs without exception for the five years thereafter. REA insisted that existing contracts for conductor be retained and not affected in any way by the Reynolds-WEC deal.

MERITS OF ELECTRIC cooking were brought out recently when more than 2,000 persons ate full-course dinners prepared in 109 Westinghouse electric roasters. The occasion was the annual dinner sponsored by the Mansfield Chamber of Commerce and the Manufacturers Club. Ohio Public Service Co cooperated with Westinghouse in the demonstration. The utility, to handle the 114-kva load, installed a 100-kva transformer and secondary span and carried power into the building by means of single-phase feeders. Panels were installed at each of the ten roaster stations for the necessary heavy duty connections

Congress Planning to Cut Building Funds as Construction Costs Fall

A CONGRESSIONAL move to slash appropriation requests for all federal construction during fiscal 1950 by a flat 15% took definite form this week.

The proposal is backed by the House Appropriations Committee. First agency to feel the economy cut will be the Interior Department, whose fiscal 1950 appropriations were scheduled for committee action late this week (Mar 25).

But all federal construction budgets presented to Congress—including those for the Army's civil functions programs and various federal power projects—will be subject to the slash if the House Committee sticks by its guns.

Thinking behind the proposed reduction is that construction costs have been declining since last fall, when federal agencies made up their budget requests for the fiscal year starting next July 1. An apparent majority of the Committee feels that this price trend will continue throughout the year. They reportedly are willing to accept requests for deficiency appropriations later in the fiscal year if the cuts prove "too drastic".

The Committee's reported views on construction are supported to some extent by reports from contractors on falling costs of construction materials, equipment, and labor. The *Engineering-News Record* index of construction costs dropped 1.25% between October, 1948, and the current month.

Application of the proposed reduction to Interior appropriations, however, suggests little if any real economy. As approved by a House Appropriations subcommittee, the slash was made on an item-by-item basis, and no specific projects were cut out entirely. With the promise of consideration for a subsequent deficiency fund, Interior builders can go ahead with present construction plans, then come back to Congress if costs do not drop by the anticipated 15%.

Major construction program in the Interior bill is that of the Reclamation Bureau, for which a total of nearly $380,000,000 was earmarked for construction. A 15% reduction of this item would leave the Bureau total appropriations of nearly $325,000,000, with slightly less than $300,000,000 for actual construction. Congress gave the agency a total of $254,000,000 for fiscal 1949, including $227,197,000 for construction.

The subcommittee's action on the bill reportedly approved some funds for all the projects covered by the Bureau's budget estimates. These included such controversial items as initial funds for the proposed Delta steam generating plant and west-side transmission lines of the Central Valley of California project; generating facilities for Canyon Ferry Dam, Mont.; the Havre-Shelby, Mont., and other disputed transmission facilities.

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Senate Committee Fights over Deficiency Measure

Tennesse Valley Authority's proposed new steam generating plant and the jobs of two Reclamation Bureau officials are the key issues in the Senate fight over the first Deficiency Appropriation bill.

The battle over funds for TVA's New Johnsonville plant actually died in the Senate Appropriations Committee. It was apparent when the Committee opened hearings on the Deficiency measure that the Senate probably would go along with the House-approved appropriation of $2,500,000 to start New Johnsonville. But a group of Senators, led by Sen. Homer Ferguson, Michigan Republican, want a test of TVA's legal authority to undertake the project.

The status of Reclamation Commissioner Michael Straus and California Regional Director Richard Boke still is in doubt. The Senate Appropriations Committee spent weeks wrangling over proposed repeal of language in appropriations legislation adopted by the 80th Congress to terminate the salaries of these two men. The House wrote a repeal of this proviso into the Deficiency bill last month.

Opposition Strong in the Senate

But opposition to Straus and Boke has been particularly strong in the Senate. In the Committee hearings and in floor debate, Sen Sheridan Downey, California Democrat, insisted the two officials were not qualified to serve in their Reclamation jobs. His opposition was impressive enough to tie the bill up in committee long after the group had disposed of all other items in the measure.

Senator Ferguson is seeking an amendment to the bill to permit "any federal taxpayer or any consumer of electric energy" not supplied with energy by TVA to seek an injunction against construction of New Johnsonville. Failing to obtain Committee support for this proposal, Senator Ferguson then carried it to the Senate floor.

As of late this week, at least, the Ferguson amendment appeared to have far less chance for success than Senator Downey's fight on Straus and Boke.

SEC RULINGS

NORTHERN STATES POWER CO (Minn.) has received authorization to borrow $15,000,000 from six banks as interim financing of its 1949 construction program. Borrowings will be represented by promissory notes payable on or before Dec 30, 1949, and bearing interest at 2%. The company's 1949 construction expenditures are estimated at $31,200,000. The financing of the balance will be provided from reserves and earnings and from additional financing the nature and amount of which have not yet been determined. It is presently contemplated that part of such additional financing will be common stock. From such additional financing, funds will be obtained to pay off the present bank loans (Release No. 8892).

ARKANSAS POWER & LIGHT CO and Lake Catherine Corp application covering the dissolution and liquidation of the Lake Catherine Corp has been authorized. The Lake Catherine Corp is a wholly owned non-operating subsidiary of Arkansas Power & Light, which owns the former's 100,000 outstanding common shares and which also has advanced $1,025,000 on open account to meet its commitments. Assets of Lake Catherine will be transferred to Arkansas, which will transfer its stockholdings in Lake Catherine to that company for cancellation and assume its liabilities, whereupon Lake Catherine will be dissolved. (Release No. 8888).

ARKANSAS POWER & LIGHT CO has received authorization to modify its charter so as to provide for, and to solicit stockholder approval of an increase in common stock capital and unsecured indebtedness. Arkansas seeks an increase in its authorized common stock ($12.50) from 2,000,000 to 3,000,000 shares. (Release No. 8894).

CENTRAL MAINE POWER CO has received the green light on its negotiations for underwriting of its offering of 286,496 shares of common stock ($10 par). The stock is to be sold to underwriters subject to the preemptive rights of stockholders. New England Public Service Co, parent, will waive its preemptive right to purchase 219,196 shares of the proposed issue, based upon its ownership of 77.8% of the outstanding Central Maine common. After negotiations with five prospective underwriters, Central Maine entered into an agreement with Harriman Ripley & Co, Inc, as representative of a group of underwriters, for the sale of the stock. (Release No. 8891).

INTERNATIONAL HYDRO-ELECTRIC SYSTEM OF BOSTON got the green light on its dissolution plans when the SEC announced the denial of a motion to reconsider its 1942 order directing the dissolution. The motion, filed by Paul H. Todd, a Class A stockholder of International, sought permission to file a plan for the reorganization of International and to introduce evidence in support thereof. Mr Todd contended that the conditions upon which the 1942 dissolution order were predicated no longer exist; that economic justification for the continued existence of International has already been demonstrated in the pending dissolution proceedings; and that reorganization was preferable to dissolution. The commission declined to interrupt the present proceedings "in view of the advanced stage of the record," stating that the record may and should contain evidence bearing on the present asset position and earning power of International and its subsidiaries which would provide the factual basis for determining the merits not only of the several plans of dissolution, but also of Todd's contention that the dissolution order should be modified. (Release No. 8920).

REPUBLIC LIGHT, HEAT & POWER CO, INC, Buffalo, N. Y., has been authorized additional bank borrowings of $448,000, under a loan agreement with the Manufacturers & Traders Trust Co. Borrowings of $1,500,000 were authorized under an SEC order issued in June, 1948. (Release No. 8922).

GENERAL PUBLIC UTILITIES CORP, New York holding company, has received authorization to sell its stock interest in New York State Electric & Gas Corp to the holders of its own common stock. GPU stockholders of record March 10, 1949, will receive transferable subscription warrants evidencing the right to subscribe to the 880,000 outstanding shares of Electric & Gas common stock ($25 par) at the rate of one share of Electric & Gas stock for each 10 shares of GPU stock, the purchase price being $41 for each share of Electric & Gas stock so acquired. No underwriting of the offering is involved. However, a dealer-manager group consisting of The First Boston Corp, Lehman Brothers, Wertheim & Co, and Merrill Lynch, Pierce, Fenner & Beane will manage a group of securities dealers which will solicit the exercise of the purchase warrants. For this service, a $1.25 per share fee is to be paid by the company. The commission conditioned its action with a requirement that, within 60 days after the expiration of the subscription period, steps be taken to list the Electric & Gas stock on a national securities exchange. (Release No. 8924).

CENTRAL MAINE POWER CO has received authorization to issue and sell its $5,000,000 of 30-year first and general mortgage bonds, Series R, subject to the results of competitive bidding. Proceeds of the financing are to be used to redeem $5,000,000 of short-term debt. Release No. 8907).

MEETINGS

International Lighting Exposition and Conference—Stevens Hotel, Chicago, March 29-April 1.

Pennsylvania Electric Association—Spring Meeting, Communications Committee, Hotel Brunswick, Lancaster, Pa., March 31-April 1; Systems Operation Committee, Wardman Park Hotel, Washington, D. C., April 6; Hydraulic Power and Systems Operation Committee Joint Meeting with U. S. Weather Bureau, Wardman Park Hotel, April 7; Hydraulic Power Committee, Wardman Park Hotel, April 8; Spring Meeting, Prime Movers Committee, William Penn Hotel, Pittsburgh, Pa., May 5-6;* Transmission and Distribution Committee, Irem Temple Country Club, Dallas, Pa., May 12-13. Spring Meeting, Meter Committee, Abraham Lincoln Hotel, Reading, Pa., May 19-20.

Edison Electric Institute—Annual Sales Conference, Edgewater Beach Hotel, Chicago, April 4-7; Accounting Division Joint Conference with American Gas Association's Accounting Section, Book-Cadillac Hotel, Detroit, Mich., April 11-14;* Engineering Committees, Edgewater Beach Hotel, Chicago, May 2-4; Annual Meeting, Traymore Hotel, Atlantic City, May 31-June 2; Hydraulic Power Committee, Shirley Savoy Hotel, Denver, Colo., June 22-25.*

Northwest Electirc Light & Power Association—Engineering & Operating Section, Boise Hotel, Boise, Idaho, April 6-8; Business Development Section, Hotel Utah, Salt Lake City, May 9-11; Personnel Section, Benjamin Franklin Hotel, Seattle, Wash., May 25-27; Accounting & Business Practice Section, Vancouver Hotel, Vancouver, B. C., June 23-24.

Missouri Valley Electrical Association—Engineering Conference, April 6-8; Rural Rountable, May 4; Sales & Rural Conference, May 5-6; Accounting Conference, May 12-13; Annual Meeting, May 17. All meetings at the Hotel President, Kansas City, Mo.

American Institute of Electrical Engineers—Conference on the Industrial Application of Electron Tubes, Statler Hotel, Buffalo, N. Y., April 11-12; South West District, Baker Hotel, Dallas, Texas, April 19-21; Summer General Meeting, New Ocean House, Swampscott, Mass., June 20-24.

National Association of Corrosion Engineers—Annual Conference and Exhibition, Netherlands Plaza Hotel, Cincinnati, April 11-14.

Western Metal Congress & Exposition—Shrine Convention Hall, Los Angeles, April 11-15.

Tenessee Valley Public Power Association—Annual Convention, Peabody Hotel, Memphis, Tenn., April 11-16.

Southeastern Electric Exchange—Engineering & Operation Section, General Oglethorpe Hotel, Savannah, Ga., March 24-25; Annual Conference, Boca-Raton Club, Boca Raton, Fla., April 13-15; Power Sales Conference, Henry Grady Hotel, Atlanta, Ga., May 5-6.

Midwest Power Conference—Sherman Hotel, Chicago, April 18-20.

Rocky Mountain Electrical League—Annual Spring Conference, Plains Hotel, Cheyenne, Wyo., April 21-22.

National Electrical Wholesalers Association—Annual Convention, Netherland Plaza Hotel, Cincinnati, Ohio, May 2-6.

Indiana Electric Association—Annual Young Men's Utility Conference, Ipalco Hall, Indianapolis, May 2-3.

American Society of Mechanical Engineers—Spring Meeting, Hotel Mohican, New London, Conn., May 2-4.

Electrochemical Society—Spring Meeting, Benjamin Franklin Hotel, Philadelphia, Pa., May 4-7

American Public Power Association—Annual Convention, Ambassador Hotel, Los Angeles, Calif., May 10-12.

Instrument Society of America—Spring Meeting, Royal York Hotel, Toronto, Canada, May 12-13.

National Fire Protection Association—Annual Meeting, Fairmont Hotel, San Francisco, Calif., May 16-19.

New Jersey Utilities Association—Spring Meeting, Seaview Country Club, Absecon, N. J.,, May 20

Pacific Coast Electrical Association—Annual Meeting,, Coronado Hotel, San Diego, Calif., May 25-27.

Public Utilities Advertising Association—Annual Meeting, Netherland Plaza Hotel, Cincinnati, Ohio, June 20-21.

American Society for Engineering Education—Annual Convention, Rensselaer Polytechnic Institute, Troy, N. Y., June 20-24.

American Society for Testing Materials—Annual Meeting, Chalfonte-Haddon Hall Hotel, Atlantic City, June 27-July 1.

Canadian Electrical Association—Annual Meeting, Banff Springs Hotel, Banff, Alberta, Canada, June 28-30.

* Additions this week.

Electric Revenues in '48 Totalled $4,156,461,000

Electric operating revenues of the larger privately owned electric utilities in the United States exceeded $4,000,000,000 for the first time in 1948, amounting to $4,156,461,000 compared to $3,697,898,070 received in 1947, the Federal Power Commission reports. This is an increase of 12.4%.

Increase in revenues from service to industrial users amounted to $1,193,738,000 in 1948, up 12.5% from the 1947 figure. Revenues from residential service were $1,216,161,000 and from commercial service $947,848,000, representing increases over 1947 of 11.5% and 12.6% respectively.

Sales of energy to ultimate consumers in 1948 passed the 200 billion kwhr mark for the first time, totaling 202,917,000,000 kwhr, compared to 184,847,322,000 kwhr in 1947, an overall increase of 9.8%. Sales to industrial consumers increased 8.8% to 106,950,000,000 kwhr. Sales to residential consumers were 39,817,000,000 kwhr and to commercial consumers 33,433,000,000 kwhr, representing increases of 14.7% and 12.9%, respectively.

Electric operating revenue deductions, including operating expenses, depreciation, and taxes were $3,371,411,000 in 1948, compared to $2,937,226,979 in 1947. Fuel expenses of $771,059,000 were up 30.5% for the year, and salaries and wages increased 10.8% to $808,784,000.

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BCER Doubles Capacity

A third 47,000-hp hydroelectric unit will be added to British Columbia Electric Railway's Ruskin station in the Fraser Valley, at a cost of $2,500,000. The new unit is expected to be in operation in October, 1950. Together with the two 62,000-hp units going into operation at Bridge River this year, it will complete the BCER's doubling of hydro electric capacity in the Lower Mainland since the war.

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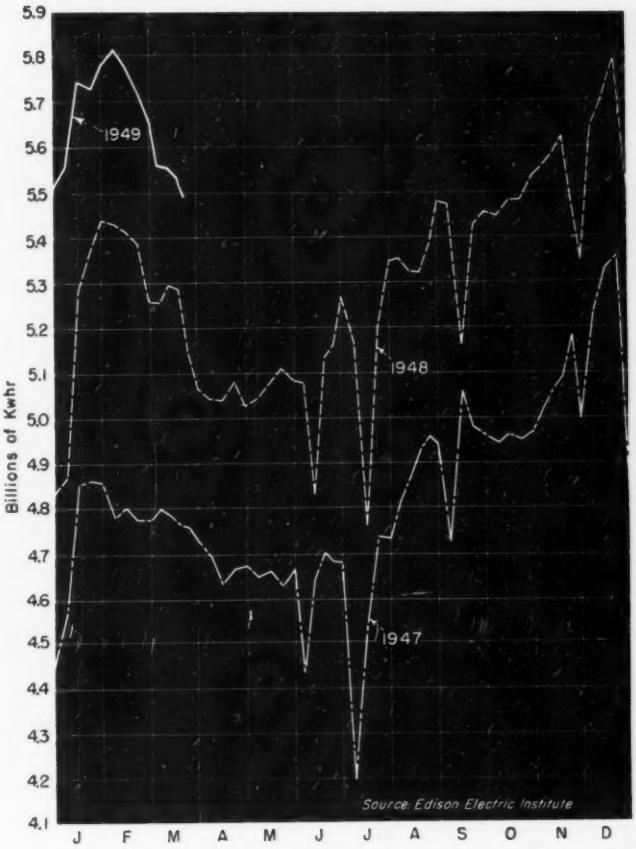
FP&L to Build Plant

Florida Power & Light Co will spend approximately $10,000,000 on a 66,000-kw plant as part of its current $108,000,000 expansion program. Two sites are under consideration, one in the Green Cove Springs area, 25 miles south of Jacksonville, and the other near Palatka, 30 miles farther south. Initial plans call for a 33,000-kw unit to be in operation by 1951 and another 33,000-kw unit for completion in 1955.



Output Percent Increase Widens to 6.8

The amount of electrical energy distributed by the electric light and power companies of the country during the week ended March 19 amounted to 5,495,769,000 kwhr, according to figures released by the Edison Electric Institute. This total compares with 5,530,629,000 kwhr for the preceding week.

During the corresponding week last year, ended on March 20, the total output amounted to 5,145,430,000 kwhr, this year's figure representing an increase of 6.8%. This was the highest percentage increase since mid-February.

Two factors apparently account for the narrowing of gains over last year in February and early March. One is that industrial activity has slipped further behind the corresponding months of 1948. This is especially true of sections like New England, where the lighter industries predominate. Also important is the fact that last February was one of the coldest in recent years, with unusually high heating loads. February and early March of 1949 were surprisingly mild in the Eastern states, which account for most of the residential power consumption.

Weekly Output, Millions Kwhr

1949	1948	1947
Mar 19 5,496	Mar 20 5,145	Mar 22 4,759
Mar 12 5,531	Mar 13 5,285	Mar 15 4,764
Mar 5 5,552	Mar 6 5,293	Mar 8 4,787
Feb 26 5,559	Feb 28 5,252	Mar 1 4,797
Feb 19 5,650	Feb 21 5,254	Feb 22 4,778
Feb 12 5,722	Feb 14 5,385	Feb 15 4,778
Feb 5 5,778	Feb 7 5,412	Feb 8 4,801
Jan 29 5,810	Jan 31 5,429	Feb 1 4,777
Jan 22 5,769	Jan 24 5,436	Jan 25 4,856
Jan 15 5,727	Jan 17 5,370	Jan 18 4,857
Jan 8 5,742	Jan 10 5,278	Jan 11 4,853
1948	1947	1946
Jan 1 5,562	Jan 3 4,868	Jan 4 4,574

Percent Change from Previous Year

	Mar 19	Mar 12	Mar 5
New England	— 2.8	— 4.2	— 3.8
Mid-Atlantic	+ 2.3	— 0.0	+ 0.4
Central Industrial	+ 6.1	+ 5.0	+ 5.5
West Central	+12.4	+ 9.4	+ 8.9
Southeast	+10.3	+ 8.9	+ 9.3
South Central	+ 9.3	+ 6.7	+ 7.2
Rocky Mountain	+14.7	+12.2	+11.4
Pacific Coast	+ 8.9	+ 4.7	+ 4.4
Total United States	+ 6.8	+ 4.7	+ 4.9

WASHINGTON COMMENT

WILLIAM B. WHICHARD

AT LEAST one recommendation of the Hoover Commission on government reorganization seems certain of adoption this year. It's the proposal, running through reports of the Commission and its task forces on half a dozen federal agencies, to increase salaries of bureau chiefs.

Bills to boost the pay of top cabinet officers and heads of major bureaus and independent agencies have gone through committee hearings in both the Senate and the House without any serious opposition. They have the backing of the President.

The idea was not new with the Hoover Commission. Just last year, similar legislation came within a hair of enactment by Congress, only to get bogged down in a general log-jam of bills lost in the rush before adjournment. But no one has done a better job of pointing up the need for such action than the Hoover group.

In its report on regulatory agencies, for example, the Commission made the pay raise one of its principal proposals for reform. The report stated flatly that the salaries of regulatory commissioners are "too low." The present pay scale, the report continued, simply "cannot attract men of the desired caliber."

The task force report on regulatory bodies spelled out the effects of the long-frozen $10,000 salary on policy and functions of such agencies. Its findings are sufficiently grave to give those industries now subject to various phases of federal regulation a vital interest in the pay-raise legislation.

The organization of the regulatory commissions ordinarily would compensate for the necessity of appointing a new member who may not be thoroughly familiar with the industries controlled by the agency. His term will be long enough to permit his gaining such knowledge, and, by tradition, he generally can expect to be reappointed. Further, due to the one-member-a-year system of appointments to regulatory commissions, he can expect to serve with veterans having the experience a newcomer lacks.

But this balance of tyro and veteran commission members falls apart if the experienced members won't stay on the job. They won't, the Hoover task force reports, because of the low rate of pay. In fact, many members remain barely long enough to get their feet wet in the regulatory waters.

Here is the record, as reported by the task force. In its 12 years of existence, the Maritime Commission has lost 13 members after an average of less than four years of service; all incumbents have less than two years in office. Securities and Exchange Commission in its 15 years has seen 15 of its members resign after serving an average of three years. Nine members of the 10-year-old Civil Aeronautics Board quit in an average of three years. In 14 years the Federal Communications Commission lost 15 members who had been on the job less than four years.

The siphoning off, to more remunerative fields, of the most able regulators is only one of the more serious effects of this heavy turn over. Continuity of policies on the part of a regulatory agency is vital so that the industries regulated may plan ahead. As the Hoover research group noted, industry must expand and adopt new methods "despite public regulations." Management, therefore, "should be able to rely on uniformity and continuity of underlying policy" in regulation. The commissions have "fallen short" of uniformity and continuity largely because of the turnover among the policy makers.

TECHNICAL NOTES

ARCHER E. KNOWLTON

From papers presented at the recent convention of the Institute of Radio Engineers

Cybernetics is the new science aimed at electronic study of the nature of the brain and the senses of living creatures.

Supersonic vibrations from a crystal when focussed on otherwise unmiscible substances (e.g. oil and water) can force them into complete homogenization.

Pulse modulation promises to multiply the usefulness of a given channel a dozen times by sampling as many different signals for successive fractions of each interval. Television can be sampled 10 million times per second and transmitted 50 million pulses per second.

X-rays have been speeded up to the point of affording blurless motion pictures of obscured moving objects; radar techniques coupled with a shutterless camera.

Television is less a problem for apartment dwellers now that electronic multicouplers enable a single antenna to supply signals to several receivers.

Transistors—principally minute germanium crystals with cat-whisker contacts 0.002 inch apart—can give 100-fold amplification with small biasing battery input.

Binary computers, simplified forms of the famous wartime Eniac, promise to help design engineers to eliminate much of the guesswork that still pervades even the most refined designs.

Shielded lead-in cables have been devised to minimize the "snow" and "ghosts" in television reception attributed by the manufacturer to "transmission line pickup" of reradiation, automobile ignition and fluorescent lighting disturbances.

Financing Depends on Earnings Earnings Depend on Sales

Power companies must turn more to equity financing for new construction money and to do so must show earnings that will attract stock investors

AS OF NOW, expansion of electricity supply systems is drawing ahead in its race with growing load. Will it stay ahead?

Yes, if the money for new construction keeps on coming.

Will the money keep on coming?

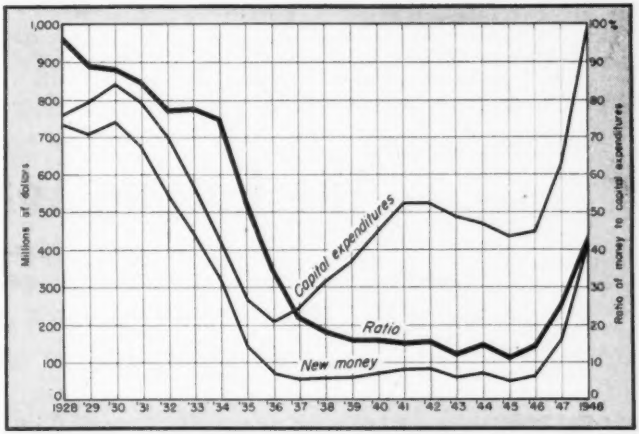
Yes, if earnings are such as to make equity securities of the industry attractive to investors.

These "if's" state the big problem confronting the power companies today. Let's examine them.

In the ten years 1939-1948, new money entering the electric utility business amounted to about $2.4 billion. In those ten years, about $6.7 billion was expended by the utilities on new construction. The difference of $4.3 billion came from operations, that is, from depreciation reserves and retained earnings.

In the next five years the electric utilities will probably require 50% more money for new plant than they did in the past ten. The amount may be more than $10 billion. Of this, probably not more than $2 billion can be counted on as coming from operations. This means that as against, say $2.5 billion of new money in the past ten years, up to $8 billion will be required in the next five.

If the industry is to maintain its present debt-equity ratio, that is, about half the money invested in it in mortgage bonds and half in preferred and common stocks, then up to $4 billion in stocks will have to be taken by investors in the coming five years. If this ratio is largely departed from in future financing, investors will shy away from all power company securities, both bonds and stocks.



NEW MONEY coming into the power supply business has started an upward climb

On this point, Winthrop W. Aldrich, chairman of the Chase National Bank, said in a recent address*:

"The trend towards an increasing debt ratio in the industry brought about by the sale of a disproportionate amount of debt securities should be a matter of managerial concern from this time on. True, this may have been the cheapest and easiest way to finance. I fully understand the attraction of extraordinarily low interest rate which, together with tax credits for interest payments, results in somewhat higher earnings for your stocks. The debt trend should, however, be reversed. When high need for construction comes along with high prices for construction—and they always come together—it becomes clear that if the borrowing capacity which is the last resource in emergency has been fully utilized before the emergency arises, it will not be available when most needed. And the common stockholder is not easily attracted to heavily indebted companies."

Therefore the prime present concern of the utilities in financing is to make their equity securities, preferred and common stocks, attractive to investors. To do this they must show

* At a dinner sponsored by the Westinghouse Electric Corporation, Pittsburgh, February 16, 1949.

adequate earnings. Some companies have long-established records of adequate earnings; some have not. But whatever its record may be, there is hardly any company whose present earnings are such as to inspire gold-rush enthusiasm in investors' bosoms. The recent and present rash of applications for rate increases, epidemic in the industry like measles in an orphanage, is evidence of the general inadequacy of earnings.

Here again, a quote from Mr. Aldrich's address:

"The commissions for many years have been engaged in reducing your rates as your technological advances and increases in volume made it possible. It is quite a change to be confronted with requests for rate increases which are needed right away. Therefore,—it would not be surprising if the needed rate increases were not forthcoming in sufficient amounts or rapidly enough—."

The answer to the problem was mentioned in passing by Mr. Aldrich. He instanced "increases in volume" as one factor in making rate reductions possible in the past. If increases in volume can reduce rates, then they certainly can raise earnings. And how are increases in volume achieved? By selling.

Without sales there would be no earnings at all. Rate increases and economies in operation can only add their bits to what selling has created. It is only logical that when earnings must be greatly enlarged, recourse be had to their wellspring, which is sales.

Earnings come from revenues. Revenues come from sales of energy for many uses by different groups of customers. Each energy use is a specific source of revenue. The revenues from the different sources have different contents of earnings. It is the job of selling not only to achieve the increases in volume mentioned by Mr. Aldrich, but also to achieve them from revenue sources that promise most in earnings and also, by the very nature of the business, most in benefit to the consumer. This is selective selling.

Following articles in this Selective Selling group expand and particularize the theme. But the weightiest argument is stated in the title of this first article, "Financing Depends on Earnings — Earnings Depend on Sales," because, if equity securities do not attract investors the expansion program of the power supply industry will be in danger of bogging down. That's the crux of the whole matter, and that's why selective selling is a "must."

The Coming Load

Trend to greater use of electricity in home, trade and industry, plus selling efforts of electrical goods makers, provides opportunity for best use of selective selling

FUTURE LOAD can be regarded by electric utility management in two ways. One way is simple—to do nothing about it until conditions force action of some kind or other; to wait until problems arise before giving thought to their solutions; and to hope for the best.

The other way is to forsee, as clearly as present indications allow, what the components of future load will be; to estimate their potentialities; and to plan how they may be shaped and timed for optimum effect on the well-being of the utility.

Actually, no utility follows the "do nothing" policy entirely. It just is not possible. A certain amount of seeing ahead is unavoidable even by the management most determined not to look. Neither is it possible for the potentialities of future load to be appraised absolutely correctly, and its components exactly molded into the shapes most desired. In the wide range between the negative of do nothing at all and the positive of do everything perfectly lie the sales policies and activities of all electric utilities. The more that their collective sales policies and activities tend to the positive side, the better it will be for everybody, utilities and their customers.

Whatever may be the position of any utility in that range, its load will certainly grow. It is true that the immediate post-war market for electrical goods has passed its peak. Appliance production has pretty well caught up with demand. One hears of price cutting as dealer stocks accumulate. Much of the post-war expansion and rehabilitation of industry has been completed. There is a let-down. But the let-down will not go down very far, not if the producers of electrical goods can do something to prevent it.

Capacity for production of electrical appliances is two or three or more times what it was before the war. The American people have demonstrated that they want electrical living even though at the moment they appear to be slacking off in the purchase of its appurtenances. This condition is a challenge that makers of appliances must accept. They can not afford to let their immense production capacity lie idle. They realize that the day of competitive selling has come. During the week before this issue of ELECTRICAL WORLD went to press three of the largest makers announced price reductions on major appliances. One manufacturer plans to spend $1 million this year on a coffee percolator. All are busy with

plans to re-invigorate the buying urge for their products.

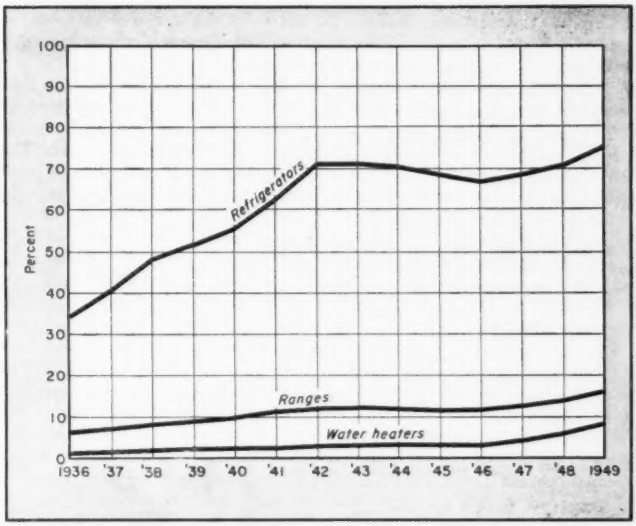
The same condition confronts the makers of electrical equipment and apparatus used by the industrial and commercial customers of the utilities. These markets are slacking off too. But here also exists an underlying disposition to make continually larger use of electrical facilities, on which electrical manufacturers are not slow to capitalize in terms of selling plans.

Another factor the utilities must take into account as they consider future loads is the new ways of using electric service. Outstanding in this picture are house heating and television. There are many others, however, that in collective effect may be more important from the standpoint of utility load. "Electrical Merchandising's" tabulation of appliances sold in 1948 lists 44 items, exclusive of lamp bulbs and tubes and certain non-electrical devices. The 1941 tabulation contains 32 such items. This is to say that before the war 12 of the 44 different appliances now in use either did not exist at all or their sale was so small as to be neglected in the statistics.

Greater Load Potentiality

An accompanying table lists 51 household appliances with their estimated wattages and annual energy consumptions. According to this table 10 of the 12 additional appliances in the 1948 "Electrical Merchandising" list have a combined connected load of 7,525 w and an annual energy usage of 2,750 kwhr. Total annual consumption of all appliances in the table is 10,050 kwhr. Posing 2,750 against the pre-war 7,300 kwhr says that the residential load potentiality just in terms of new appliances is now one-third greater than it was before the war.

Also to be considered is volume of appliance sales. In the last year before the war, about 30 million electric appliances exclusive of lamp bulbs and tubes were sold. In 1948 the number was 76 million. Increase in number of residential customers, 1941-1948, was about 30%, but the increase in appliance sales volume was over 150%. Some of the difference between 30% and 150% can be attributed to the appliance sales holiday of the war period. But most of the difference asserts in positive terms that the American people are using more and more electricity in their daily living. That trend must be taken as the basic factor in the thinking of utility management in regard to the future residential load.



SATURATION CURVES of major appliances show significantly sharper upward trends for water heaters and ranges during the post-war period than at any previous time

Directly in line with that trend are developments in electric house heating. This is a service that some utility customers already enjoy and that many more want. And as time goes on the number who want it will increase. What dominant form electric house heating will eventually assume is beside the point. Possibly the heat pump will shortly be developed to such perfection as to take the dominating position. Possibly resistance heating, convection or radiant, will pre-empt the field. It is even possible that dielectric heating will enter the picture. These are matters that must be considered but they are of small moment in comparison with the main consideration which is that house heating is a service that the utilities must sometime undertake and that requires the best in long-range thinking by utility management. For a few utilities the problem of house heating service is immediate and pressing; for most it may seem comfortably far in the future. But new things often have a way of appearing on the scene much earlier than they are expected. Some utility managements now happily secure in the thought that house heating won't bother them for a long time may wake up some bright morning and find the problem, not just waiting on the door step, but pounding on the door and threatening to break it in. That's pretty much what happened to the utilities that are now coping with house heating load.

In view of its present status and of its potentialities, house heating should receive the thoughtful consideration of utility management. Rather than ignore it or resist it and thereby let it develop into a troublesome thing, wisdom says that now, in its beginning, is the time to shape it into a willing service that will pay its way. Here, as never before, the utility has opportunity for selective selling in the full meaning of the term, which includes provision for the coming load, compensatory rates, and direction of promotional effort.

Another new load that stands out

as utilities look towards tomorrow is television. But its substance is not convincingly apparent, its contours not clearly defined. More was known—that is, was thought to be known—a year or so ago about television as a utility load than is known now. In 1948, 850,000 television sets were sold, against about 180,000 in 1947, according to "Electrical Mechandising" data. The market is broadening rapidly as net-works are extended and new stations begin operations. Receiver sales in 1949 are estimated as high as 2,000,000.

As yet, however, no competent data are available as to the effect of television on electric system load. It is not likely that such data can be collected for some time to come, not until receiver saturation has increased considerably and the novelty of a moving picture by radio wave has worn off. However, there is one definite thing that can be reported about television. It is that utilities are much less excited—or perturbed—about it than they were.

Estimates of Wattage and of Annual Consumption of Electric Household Appliances Assuming Normal Use

Appliances:	Wattage	Kilowatthours
Bed Covering	200	140
Bottle Warmer	415	10
Broiler*	1320	105
Clothes Dryer	4000	365
Clock	2	17
Cooker (fireless)	650	75
Cooker (egg)	530	15
Corn Popper	600	5
Curling Iron	25	5
Dish Washer & Disposer*	450	75
Disposal Unit only	310	10
Fan (attic)*	365	235
Fan (desk)	70	30
Fan (ventilating)*	75	40
Floor Polisher	220	15
Fruit Extractor	75	5
Germicidal Lamp	20	155
Grill	675	25
Hair Dryer	200	5
Health Motor	250	5
Heat Lamp (infrared)	250	20
Heater (radiant)	1000	90
Heating Pad	55	5
Home Freeze Cabinets*	230	600
Hot Plate	1050	85
Immersion Heater	330	5
Iron	950	100
Ironing Machine	1500	140
Mixer (food)	110	10
Oil Burner	260	315
Percolator	475	60
Range	9500	1250
Radio	100	100
Radio Phonograph	100	110
Razor (electric)	15	1
Refrigerator	215	350
Room Cooler*	670	935
Roaster	1300	215
Sewing Machine	75	10
Small Motor	100	10
Stoker	250	270
Sun Lamp—R S type	275	5
Sun Lamp—S 1	385	30
Television*	315	295
Toaster	900	30
Vacuum Cleaner	250	25
Vibrator	45	2
Waffle Iron	800	10
Washing Machine (all types)	250	45
Water Heater	2660	3400
Water Pump	265	190

Source: Edison Electric Institute.
*New or much enlarged uses post-war.

The trend towards larger utilization of electricity so apparent in residential service is plain also in respect of other customer classes. The value of lighting planned as a sales stimulator is becoming increasingly apparent to retail merchants. Modern light sources are so diverse and flexible, and so efficient, that decisions on their applications are made primarily on the results they accomplish and only secondarily on their costs. Store operators appreciate that customer comfort is a large factor in sales, and air conditioning becomes necessary. Refrigeration assumes an ever increasing responsibility in food handling and selling. Electric cooking in restaurants and other places of food service ever more convincingly demonstrates its values in cleanliness, cost, comfort, and customer appeal. Selective selling based on accurate and comprehensive knowledge of load characteristics of utilization devices and of customers' requirements can be most rewarding in this field.

In Industrial Sales

An almost universal post-war phenomenon in American industry is the rise of the "break-even" point. This is the point in volume of business where income just equals cost. Above it is profit, below it, loss. The height of the point has two components, cost varying with volume of business and cost constant irrespective of volume. Management tries to reduce both costs, of course, but logically the constant cost usually receives first scrutiny. This will inevitably make isolated plant generation of electricity much less attractive than it has been, particularly in view of the present price level of power production equipment.

In regard to the volume-variable component of industrial cost, electric service also is important. The production cost economies of automatic and controlled operations possible in the many different ways of electric drives and controls, of heat applications, and of lighting all offer help in decreasing the break-even point.

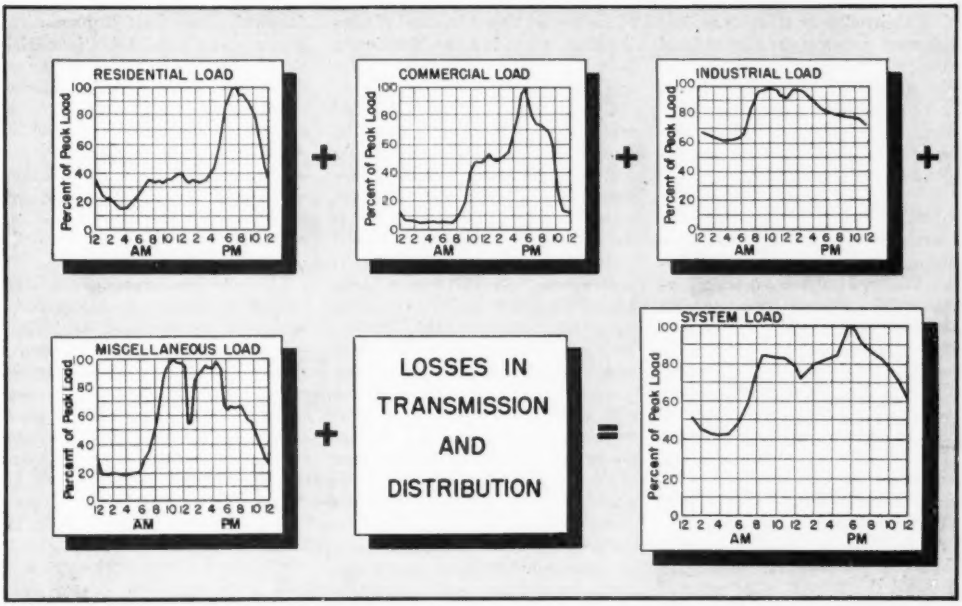
Knowing the customer's needs and how they can be met by the modern resources of electricity utilization is the key to selective selling in industrial power service.

In strict accountability, it can probably be said that electric service to most farm and rural areas is not compensatory, not if all its costs, from coal pile to consumers' meters, are exactly assessed against it. Whether or not this is true it is incontrovertible that earnings on such service are thin. It is also incontrovertible that the farm and rural load will grow, because the folks living in the country want the benefits of electric service probably even more than do the urban dwellers, and the makers of electrical goods will work just as hard to sell their products in the country as in the city. This being so, it seems only commonsense that the electric utilities should do all in their power, via selective selling, to shape and to accelerate that load growth into form and timing most beneficial to their customers and to themselves.

Street Lighting Selectivity

Of necessity this discussion of future load is sketchy and incomplete. However, it should not be closed without mention of another important load—street and highway lighting. Here also great improvements in light sources and associated equipment have been made, manufacturers are doing an impressive selling job, and it is certainly true that rapidly increasing traffic volume provides a large market. In terms of location and timing it is desirable load and thus should be a prime objective in selective selling.

In every field of electric service load growth impends. How this growth will be handled, how its demands will be met, how it will be fostered and shaped, are matters for utility management decisions. Upon those decisions depend the earnings of the industry, in fact, its whole future depends on them. Earnings have no other source than sales. Sales can vary in volume, kind and timing. Informed, intelligent and vigorous selective selling can determine the volume, kind and timing of sales to result in most benefit to both the supplier and the user of electricity.



PROBLEM OF SELECTIVE SELLING is to shape the curves of residential, commercial, industrial and other loads so that, plus losses, they will add up to a total system load which will provide maximum earnings on the investments to serve it.

Load Molding Requires Load Knowledge

Ways of use and numbers in use of electric utilization devices determine load characteristics which must be known for the making of sales plans

PRACTICALLY EVERY ASPECT of power company management enters into the consideration of selective selling in greater or less degree, depending on the circumstances of time and place. Concerned in selective selling determinations are employee and public relations, rates, system planning, operating procedures, production economics. Underlying these concerns are three fundamentals:

1. Characteristics of customers' uses of electricity.
2. Customer classes and groups within classes.
3. Locations of prospective loads.

The third of these fundamentals is the simplest. It consists of engineering-economic determination of where on the system load development is needed or where it can be accommodated for optimum results. The factors in this equation are comparatively few, easy to set up; and the answer can usually be reached by simple arithmetic.

But the two other fundamentals are much more complex. Each covers a vast field containing many factors, most of which can be determined only by pains-taking research and competent analysis of the data obtained.

Consideration of characteristics of customers' uses of electricity immediately divides itself into two parts. One covers the characteristics of the utilization devices themselves—light sources, domestic appliances, industrial equipment or whatever. As respects given devices, these characteristics are fixed.

But the ways and the numbers in which people use electric lamps, appliances, motors, are extremely variable. They are variable as to time and place, as to climate, season, living habits, economic circumstances, a host of different conditions. And the ways of use and the numbers of utilization devices in use determine the characteristics of those devices as loads on electric systems. Therefore, if data on load characteristics of them are to be competent and dependable factors in load development plans, if data are to be used

for the direction of selective selling, they must represent the current local scene. To be thus representive, the data must either have been obtained by local research or have come from other places where local circumstances and conditions are reasonably well approximated.

The need for current local data is well illustrated by a ratio that is in wide use as a determinant of selective selling. Some years ago the Philadelphia Electric Co found out, in its continuing load research program, that when both ranges and water heaters are components of residential load the best economic results for the utility are obtained "when the water heaters are operated on a controlled basis and when the ultimate market saturation of these appliances approximates the ratio of two ranges to one water heater" (ELECTRICAL WORLD, May 22, 1948, page 131).

At the time, 10 years or so ago, when the Philadelphia Electric Co disclosed the 2 to 1 ratio, national saturation of water heaters was 3% or less, ranges about 10%. Now, according to "Electrical Merchandising", the respective saturations are 9% and 16.6%. The national ratio of range and water heater saturations is today less than 2 to 1 (16.6 to 9). This being so, then there must be many places in the country where the ratios are considerably lower. If in any of these places sales managers are plugging along trying to get two ranges on the line for every one water heater or are not thinking about uncontrolled water heater service and its sales opportunities—well, what price selective selling?

Effect of Diversity

In this connection reference is made to a study of water heater load characteristics published in ELECTRICAL WORLD, November 23, 1946. This study indicates that when the water heaters in a single service group, such as on one distribution circuit, increase in number above 100, diversity so irons out their combined load that load peaks, heating element ratings and tank sizes become of rapidly decreasing importance. This says, in effect, that the more water heaters in use the less can be the cost of the heaters themselves and of serving them, which is a consideration to be taken into account in plans for selective selling.

Characteristics of industrial and commercial loads are more easily determinable than residential because customers are fewer, their loads are larger, and contacts with them are more frequent. To obtain information on the behaviors of industrial and commercial loads does not usually require the mass research methods and statistical analysis needed in the residential service field. For this very reason of easier availability it may be that sometimes not sufficient attention is given to the need for such information and to its potential usefulness in sales planning. It may not be appreciated, for instance, that modern applications of electricity as a heat source can often raise the floor of a valley in the industrial load curve or that the selling effectiveness of modern lighting can greatly improve the load factors of commercial customers.

Class Characteristics Important

The second fundamental in determinations of selective selling is knowledge of customer classes and of groups and individuals within classes. This required knowledge is multifarious. It ranges from appreciation of the comparative values of class loads in composition of the total system load to confidential information on the financial condition of an industrial customer, for instance, whether or not he is in a position to buy a new heat treating furnace.

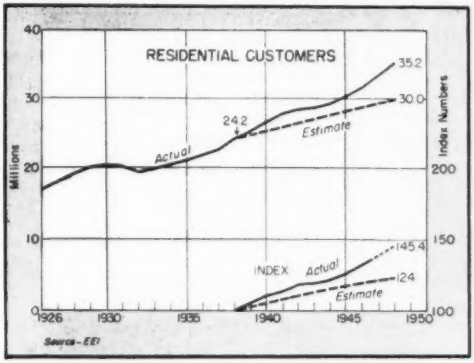
The comparative values of class loads in the system total are a matter affected by and affecting practically every phase of utility operation. It has often been stated—correctly—that large volume production of electricity for industrial loads is a principal contributor to the availability of service at reasonable rates to residential customers. For the optimum condition of greatest return on investment in utility plant, towards which selective selling is aimed, major class loads should be combined into total system load in definite proportions. Thus, while it is accepted that industrial load is a desirable complement to residential service, how large in proportion is the most desirable industrial class load? The answer to this question, and to others like it in reference to other customer classes, can come only from adequate knowledge of customer load behaviors and characteristics, this knowledge leading to the most desirable integration of class loads into system loads.

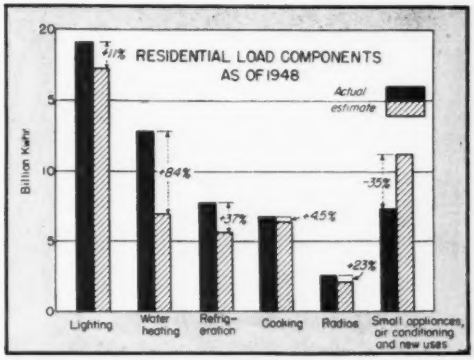
Rates Properly Designed

Earlier in this discussion rates were mentioned among other considerations as being concerned in selective selling determinations. The importance of rates in selective selling is much greater than is indicated by that group mention. Obviously the most careful integration of class loads into system load means nothing at all unless rates are properly designed in themselves and are properly proportioned as between customer classes to result in adequate earnings.

It is not the intention here to embark on a discussion of rate philosophy. But there are two aspects of rates impinging so directly on selective selling that they must be taken into account in this article. One aspect is that the rate applying to any particular load development is compensatory and will remain so as the load growth continues. The other is that the rate schedule be so set up as not to result in discrimination between customers who add new loads and others who do not.

There will never come a time when any utility sales head can slap the dust off his hands and say, "There, now the job is done". He will never be able to tell his boss that sales of energy to customer classes are so proportioned that maximum possible revenue is now combined with maximum possible economy in production and other operations. But he can always—and he must—work towards that unattainable end. To work towards it intelligently and resultfully, he needs full information on present and potential loads in order to set up his selective selling plans. Load molding is a matter of infinite detail. This brief discussion has only indicated its ramifications which must be thoroughly known for resultful selective selling.





OVER 5 MILLION MORE residential customers in 1948 than predicted in 1938. All load components show under-estimation except the catch-all grouping at the right. And where will "new uses," now looming up, take it in the next ten years?

Set Your Selling Sights High

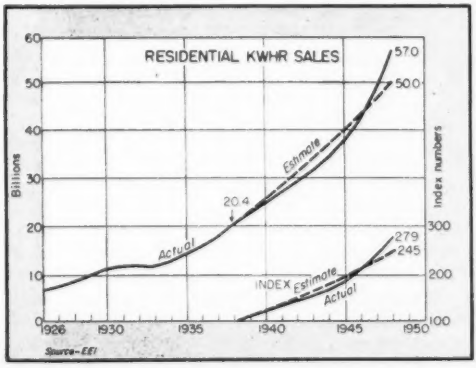
Record of past 10 years shows that apparent optimism in sales plans now may seem like actual pessimism to the backward look in 1959

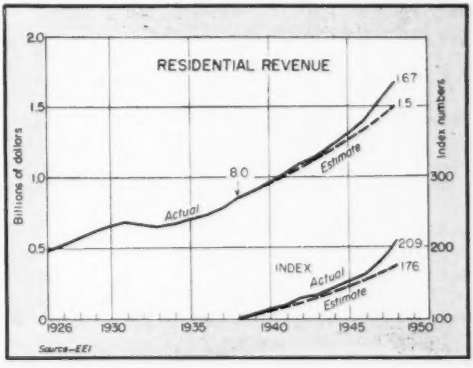
GEORGE E. WHITWELL
Vice-President in Charge of Sales
Philadelphia Electric Co

IN EACH UTILITY selective selling to residential customers will be interpreted differently. Sales plans considered essential in some communities would be unwise in others. Whatever it means in any individual instance, such selling certainly should neither be discontinued nor reduced. The future, whether it continues to be one of great demand for electricity or one that involves recession or even depression, will require production and sale of many more kwhr than customers will just take.

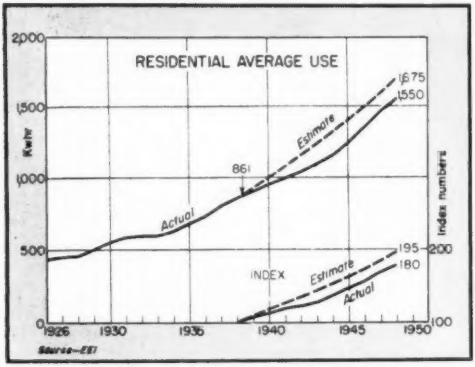
Selling is not something that can be turned on or off like a light switch to suit some condition peculiar at a given time to the electric utility industry. The problem is not as simple as that. Electric utilities are involved inextricably in the well-being of the communities they serve and in that of the nation as a whole. It is their obligation to sell continuously and with regard to the interests of all who depend upon them.

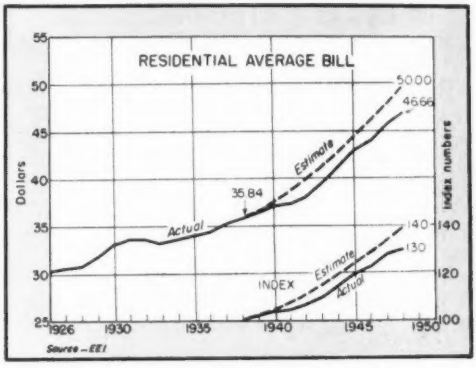
The graphs on these pages show some ten-year predictions of residential service made by the author in





ENERGY SALES ARE 14% HIGHER than estimated ten years ago, and revenue is over 10% more





AVERAGE RESIDENTIAL USE and bill are less than predicted, because the large increase in number of customers, in addition to the appliance selling holiday of the war years, acted to produce a levelling in the trend of appliance saturation

1938. The comment on these predictions at the time was that they were very optimistic. Yet, as appears on the graphs, the 1938 forecasts generally have been exceeded. Customers numbered 35.2 million in 1948 instead of the 30 million predicted. Every component of energy use is larger than was expected. Energy sales in 1948 were 57 billion kwhr instead of 50 billion. Revenue is nearly $200 million more than was predicted. Had it not been for the extraordinary increase in number of customers and for the cessation of appliance selling due to the war, average use and average bill would undoubtedly have exceeded the forecasts.

Since it is an integral part of a utility's operation, selling must be tempered to meet company conditions. Close cooperation between sales and engineering and operating departments is essential. Intelligent selectivity, where possible and desirable, should be constantly in the salesman's mind.

Major emphasis can be concentrated on those loads, such as cooking and lighting, where, for example, failure to do a job would result in competition to electric cooking entrenching itself for years and, also, in possible loss of lighting load because of the greater efficiency of fluorescent over incandescent.

Much of the effect of sales activity is delayed. To a large extent, though not entirely, this year's increase in load will result from sales pressure that has *already* been applied. This will be true in all markets.

It takes time and costs considerable money to gather sales momentum. At present there is an extreme shortage of people qualified for electric utility sales work. It is common experience today that about six months is needed to find suitable candidates. Then four to six months (much longer for industrial sales) are required for training before assignment to productive work. It is not uncommon, under today's conditions, for it to require a year or more, from the time a decision is made to employ a group of sales people, before any real sales results are secured.

Revenues that are lost because of let-up in sales pressure cannot be recovered at will, but are likely to be lost for years—some permanently. The revenue lost during the 15-yr normal life of only 1,000 unsold electric water heaters will amount to about $500,000; of only 1,000 unsold electric ranges, about $300,000. If a poor fluorescent lighting job is *bought* by the customer to replace filament lighting rather than the good job that might have been *sold*, business remains lost for years because fluorescent lighting equipment is relatively expensive and, therefore, not quickly replaced. Moreover, let it be remembered that a substantial portion of "sales promotion" is actually not immediate direct selling. But that portion is vitally involved in the matter of extra-profitable revenues which will be needed in order to meet the costs of greatly expanded utility plants.

Such promotion, as distinguished from direct selling, includes answering customers' questions regarding uses for electric service; providing layouts for lighting, cooking and wiring; and helping to advance the development of infant utilization programs that cannot provide much demand in the near future. These programs are those for all-electric kitchens and laundries, the electric blanket, home freezers, television and the heat pump. Other promotional activities are: Making proper rate applications; obtaining market data and educating both salesmen and customers on the newer applications of electricity; and maintaining necessary records. All of those things contribute to the utility's good relations with its customers and with the electric industry; they help to build the utility's territory and hence the utility's own future.

It seems apparent that selective selling, intelligently adapted to each individual electric utility, is valuable, if not essential, under any set of conditions. When regarded from the viewpoints of the demonstrated characteristics of the residential load and of the utilities' earning requirements over the near future, volume selling, carefully guided with an eye toward maximum sales of kwhr per kw of capacity, is vitally important.

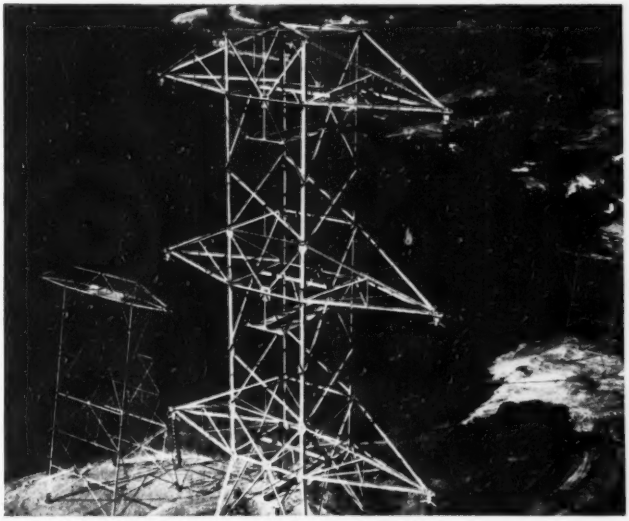
HOVERING HELICOPTER above transmission line of Southern California Edison Co. Routine inspection is made at 35-40 mph from position 10 ft above, 50 ft horizontally from nearest conductor. Broken strands and gun shot damage is visible at this speed

Air Patrol of Transmission Lines

Since the war increasing numbers of utilities are finding aircraft patrol of transmission lines faster, cheaper and in many instances as effective as ground patrol. Here typical companies report their experience

TODAY aircraft patrol of transmission lines is fast answering the dreams of power line patrolmen and utility management alike. Through the years the patrolman has yearned for relief from the hardships of his job. Management's aim has been cheaper, faster, more efficient ways to locate and correct trouble in emergencies and to speed up routine line inspection.

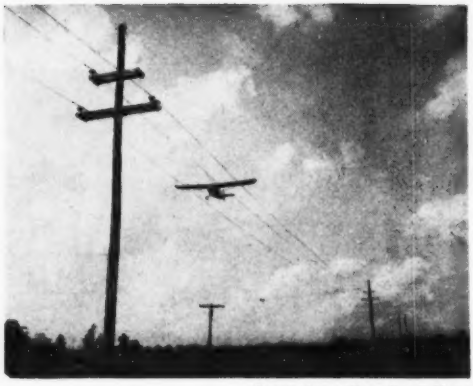
Still in its infancy, the use of light planes and helicopters for line patrol has come into use largely since the end of World War II. Some use of light planes was noted in the 1930's, but it was confined mainly to emergencies. Helicopters were not used by utilities until June, 1946, when Bell Aircraft Corp made an experimental patrol in cooperation with Central New York Power Corp. Later that summer Central Helicopters Inc, Seattle, pioneered commercial line patrol with helicopters by signing a contract with Bonneville Power Ad-



EXCELLENT VISIBILITY of tower from patroling helicopter allows inspectors to detect flashovers, rusted ground wires overlooked by ground patrols for months or years. Helicopters have in some cases reduced patrol costs up to 15%

Ryan Aeronautical Co Photo

HAZARDOUS CONDITIONS—like hay derrick located dangerously close to transmission lines—are readily spotted from air. This picture was taken from plane flying just below conductor level.



Georgia Power "Snap Shots" Photo

LIGHT PLANE PATROL is used on Georgia Power system for routine monthly line inspection supplemented by annual ground inspection. Air patrol costs one-third that of ground patrol.

ministration to inspect 2,500 miles of transmission line in three northwestern states.

In the interim, acceptance of aircraft for line patrol has grown until today numberless airport operators offer patrol service with light planes and at least half-a-dozen or more helicopter operators are patroling lines on a commercial basis.

Relative merits of light planes and helicopters for transmission patrol are the subject of controversy that divides along geographical and topographical lines. In Texas and the great plains states of the mid-west, planes are favored over helicopters. Here lines traverse flat terrain with little or no change in elevation. Distances are vast and lines generally accessible to cross country patrol by truck or car. The relatively expensive helicopter patrol offers little incentive over automobiles either from the standpoint of speed or cost. Light planes, on the other hand, operate at little more than the cost of vehicular patrol but offer several times the speed at little sacrifice in effectiveness.

In the Rocky Mountain and northern Appalachian regions, however, helicopter patrol is more common. Here rugged terrain is often all but inaccessible on the ground except to slogging foot patrol. Although light planes are not impractical under such circumstances, the "roller coaster" contour of lines is not easy to follow even at light plane speed. The helicopter, however, is at home in such environment. Its ability to hover and land "on a dime" affords opportunities to get a man on the ground almost anywhere to supplement air inspection or make temporary repairs.

In the very early days of air patrol of transmission lines inspectors doubted that defects could be spotted at speeds ranging from 35 to 50 mph. Today this concern has been largely dispelled. Light plane proponents claim ability to detect conductor burns and crossarm defects at speeds up to 80 mph on single-circuit lines. Helicopter patrolmen report that they can move along double circuit 22 kv lines at 50 mph and observe conditions adequately. However, both light plane and helicopter proponents agree that the concentration required makes air patrol a tiring task and that if patrols are too long efficiency drops off sharply.

The reports that follow summarize the specific experience of a number of companies experienced in air patrol.

Pennsylvania Electric Co
Johnstown, Pa.

On the basis of two partially complete inspections of its transmission system by air from a helicopter Penelec engineers conclude that: (1) This method of patrol is in some respects far superior to foot patrol for routine inspection, (2) it cannot supplant foot patrol entirely, (3) a ratio of one foot patrol to two aerial is possibly the ultimate expected use of the helicopter on this system's 627 structure miles of 66, 110 and 132-kv lines, (4) the cost of air patrol is about 15% more expensive than ground patrol, and (5) for emergency patrol the helicopter is far superior under flying conditions.

The system patrols to date have covered 975 miles of line (8,746 structures) in a total flying time of 45.7 hours, of which 34.9 hours (76.5%) was inspection time and 10.8 hours (23.5%) was dead flying time. The average of about 28 miles of patrol per hour compares with 4 to 10 miles per day on foot.

While 160 miles of wood pole H-frame line (1,557 structures) has been covered in a single day's patrol, which included 1 hour and 40 min of unproductive flying, this amount of inspection is not recommended as a steady diet, especially on older lines where structures show some signs of deterioration and many notations must be made of the conditions observed. About 100 to 120 miles (1,000 to 1,200 structures) on the Penelec system is a day's intensive work for both pilot and observer.

Advantages of helicopter patrol over foot patrol lie in the fact that the structure top is viewed from a comfortable, advantageous position (generally from a distance of 10 or 15 ft above and a little to one side of an outer phase). Insulators are seen as individual units, not strings. The 6 ft x 8 ft wood crossarms in

general use on H-frames are easily inspected. Damage can be closely observed, and the top, where rot generally starts, is easily visible. Stream crossings and hilly terrain are no problem, and the observer in mountainous country is looking for line trouble—not rattlesnakes.

However ground conditions cannot be closely observed. The condition of poles or tower bases, anchors, clearances above ground or over obstacles and encroachments on the right-of-way are best seen from the ground. It is for this reason that complete elimination of ground patrol is not recommended.

Southern California Edison Co, Los Angeles

After 24 months of experimentation with helicopter patrol over varied terrain, Southern California Edison Co is now operating regularly scheduled patrols over 1,800 circuit miles of 220 and 66-kv transmission.

Experimentation has shown speeds of 35 mph best for double-circuit lines and 50 mph for single circuits. Most inspectors can follow conductors, observe broken strands and gun shot damage at these speeds.

First air patrols over lines usually pick up numerous items overlooked by earlier ground patrols. For example, 12 locations were found in one group of lines where ground faults had occurred and been passed up successively by foot patrols. Moderate rusting on ground wire sections was logged on other lines along with old flashovers and broken conductor strands.

Even disregarding effectiveness, air cost compares favorably with present ground patrol. In mountainous country, the helicopter cut inspection cost 15% below old methods. Patrol was formerly done in sections by different crews, at different times. From a helicopter, patrol is done by one man in one operation. This provides a consistent overall report and releases trained personnel for important work at a time when skilled help is short.

Value of the helicopter in an emergency was well illustrated by a recent emergency repair job on which three were used simultaneously, when two steel towers on a 230-kv line from Los Angeles to San Diego were collapsed by heavy icing. The damage was located from the air. Men and tools were flown in while heavy equipment broke through heavy snow to get to the spot. Three craft continued to carry men to and from the job and bring in supplies for crews and equipment.

Many additional uses for the helicopter in utility work have been developed. Reconnaisance and surveying of 256 miles of 220-kv line through mountainous country has worked out very well. The helicopter is used to check altitudes accurately as well as to mark turning points by dropping 5 lb bags of lime, or cloth streamers for the ground party to see.

Wider commercial use and further improvements in design should reduce the present helicopter rental rate of $50 per hour.

Pacific Gas & Electric Co San Francisco

Pacific Gas & Electric discontinued the regularly scheduled patroling of its transmission line in 1932 and did not resume routine patrol until recently when patrol, from the air, was inaugurated using helicopters.

Company lines crossing rugged mountainous terrain, water and swampland in the past have been patrolled only by the most difficult and painstaking methods. Helicopters were adopted when trial patrols established that this method is faster, more economical and more effective than foot patrol.

Typical of the kind of flights now being made by PG&E was a patrol in May, 1948 over a new line before it was energized. Total mileage of 220.5 was covered at an average speed of 42.5 mph. It was the longest patrol flown to date by a single observer. One flight period lasted 2 hr 10 min however. Evidence of the effectiveness of the patrol was the discovery of a broken conductor strand between two towers during the patrol at the average flight speed maintained.

During the early trial flights one 42-mile section of line was patrolled in detail from the air in 1½ hr. A detailed ground patrol over the same line was then made by lineman and truck driver. The ground patrol took eight working days and cost an estimated 350 during dry weather when all towers were accessible by truck. After rains about 1/3 of this line is inaccessible except by horse or foot. A conservative estimate of patrol cost would be $500.

Helicopter Performance Data

For 175-hp Model 47D Bell helicopter operating with normal gross weight (2086 lb) in still air under NACA standard conditions

Maximum Cruising Speed at Sea Level	92 mph
Operating Speed, Sea Level, 75% Power	85 mph
Maximum Rate of Climb at Sea Level	900 fpm
Time to Climb to 5,000 ft	7.0 min
Absolute Ceiling	12,500 ft
Service Ceiling	11,500 ft
Hovering Ceiling (in ground effect)	5,400 ft
Range; Sea Level 75% Power	212 mi
Endurance: Sea Level, 74% Power	2.5 hr
Maximum Endurance, 60% Power	3 hr

WEIGHT DATA

Maximum Allowable Gross Weight...2,200 lb

Standard Configuration: Included are (1) Two side-by-side seats; (2) Canopy cockpit enclosure and doors; (3) Dual C controls; (4) Complete cowling

Weight Empty	1,482.5 lb
Pilot	170
Passenger	170
Fuel—33.3 gal	199.8
Oil	23.7
Baggage	40
	2,086.0 lb

Cargo Configuration: Accomplished by removal of passenger seat, one set of primary controls, side cowling (engine compartment) and mounting cargo containers.

Weight Empty	1,484.5 lb
Pilot	170
Fuel 20.3 gal	121.8
Oil	23.7
Pay load	400
	2,200.0 lb

City of Los Angeles Dept of Water & Power

Helicopter patrol has been adopted as routine by the Dept of Water and Power on the three 287.5-kv Boulder lines and for other 138 and 115-kv circuits. About 1,200 miles of line are covered monthly using 175-hp Bell model 47-B, 2-seated helicopters.

Air patrol has been found to have considerable advantage over ground patrol in locating insulators marked by flashovers and in seeing damage to tower structures and overhead ground wires. However, it does not supplant ground patrol completely as certain features, such as counterpoise gaps and tower anchorages, can be observed better from the ground. Never-the-less, it has been possible to decrease ground patrol crews materially as a result of the routine use of helicopter patrol.

Patrol speed varies from 10 to 46 mph. The helicopter usually flying 30 to 40 ft to one side and 25 ft above the tower structures *in good weather.*

With high wind velocities the helicopter is kept a considerably greater distance from the line.

During initial test with the helicopter it was established that patrol could be made 50 ft above the line at 80 mph and still land a safe distance from the lines, if the engine died.

Maximum altitude on the Boulder patrol is 4,900 ft. No difficulty has been had in setting the ship down or taking off from this height, although vertical landing and takeoff are affected by air density.

At the speed of normal patrol, time taken by the observer to write notes allows sections of the line to be passed unseen. Consideration is being given the use of a wire or disc recorder so the observer can watch and record his observations at the same time.

A transmission line carrier telephone receiver is frequently used in the helicopter so instructions from patrol headquarters can be received during flight.

The helicopter has also been tried at night using a spot light mounted on the nose. Flying 50 ft above the line, the light was trained along the conductor and switched from left to right along the cross arms as towers were approached. All insulator strings as well as deflections of wires in the tower structure itself could be seen, showing that broken conductors, shattered insulators or damaged towers could be located by night patrol.

The Department has completed three four-month contracts, and has recently awarded a six-month contract at $45 per hour. Purchase of a helicopter by the department is being seriously considered but a commercial operator will be used for the time being.

Higher Speed Craft

Not all power companies using aircraft for transmission line patrol employ helicopters. Some prefer such light planes as the Aeronca, Ryan Navion, Piper Cub and others. Typical of these are the Idaho Power Co and the Georgia Power Co, whose experience is reported as representative of utilities using light planes.

Idaho Power Co

At present about 60% of emergency line patrols and 20% of routine inspections on the Idaho Power Co system are made by plane. The figure for emergency patrols is a year-round average; in winter patrols are more frequent, in summer less frequent.

The company first used emergency air patrol in 1942; routine patrol in 1947. The use of each type had increased steadily thereafter until in 1948 about 3,500 miles of line were inspected from the air. The greater part was on emergency patrol during winter months.

Experience has led management to the conviction that air patrol has a definite place in company operations. In emergencies the time element, manpower, fatigue and the wear and tear on truck equipment made air patrols more advantageous than ground patrols. On regular routine inspections, however, these factors are not so important.

Air Patrol is Less Expensive

Experience shows cost saving for air over ground patrol. Routine inspections from the air are economical on long transmission lines especially where patrol roads are in bad condition. For example, planes have patrolled in five hours loop transmission lines which would have required two to three weeks to cover on the ground.

Plane patrolling has been found to be most satisfactory at speeds of from 80 to 100 mph and 200 ft or more above and to the side of the line. Under these conditions and with good visibility inspectors feel they can make practically as good a patrol as is made by truck.

A disadvantage of plane patrol is that many times visibility delays takeoff. This is particularly true where lines traverse mountains. Here blizzards may exist for long periods. Another disadvantage is the fact that after plane patrol has been completed and trouble located, men and materials must still be sent in to make repairs.

However, planes proved themselves on the Idaho Power system during one ice storm of the unusually severe winter of 1948-49. All roads were blocked with snow, but planes located trouble on rural distribution lines and dropped repair materials to men on snowshoe on the scene. Flying with emergency transmitter tuned to the frequency of radios on company line trucks, two power company men and a pilot patrolled over the lines for hours. The plane was in radio communication with crews on the ground and relayed reports to Boise and instructions from Boise to ground crews on skiis and snowshoes working their way along the lines.

Georgia Power Co

Isolated emergency air patrols made on this system early in 1947, using light planes, demonstrated that line defects could be readily observed from the air. Encouraged by this an experimental patrol of the entire transmission system was undertaken to: (1) Learn whether unusual line and right-of-way defects could be seen, (2) determine actual cost of air patrol, (3) decide whether air patrol should be centralized or decentralized, (4) study effect of weather conditions and (5) determine the type of equipment required.

Results of this patrol, covering 4,169 miles of single-pole and H-frame lines, and subsequent regular use on three-quarters of the system has convinced the company that: (1) Aeronca Champion or similar light planes with tandem seating is best for this work, (2) all pole line defects noted by foot patrolman can be seen from the air except pole conditions at and near the ground, (3) decay on top of crossarms can be seen from the air before it is visible from the ground.

Where facilities are available, routine monthly air patrols are being made. These are supplemented annually by a careful pole-by-pole inspection. Cost of air patrol is found to be about one-third that of a foot patrol.

Recent use was made of a Handie Talkie radio on an emergency patrol to report location of a break. The observer was able to contact a company mobile unit 20 miles away. Such use of radio can save going back to the airport to report, and in isolated spots permits crews to be directed to the break.

Weather is the controlling factor in air patrol. A 15-mph wind makes flying at altitudes 100 to 175 ft unsatisfactory. It is more difficult to patrol in the mountains but a plane is very valuable over swamps and low-flat country where patrolling can be done at the rate of 50 mph over lines almost impassable on foot.

Coordination of Distribution Protection

I—Fused Radial Systems—Breaker Tripping

Introductory article of a series discussing fundamentals of radial distribution system protection; its problems and some of the solutions. Salient points of commonly used schemes brought out

CHASE HUTCHINSON
Electrical Engineer
Ebasco Services Inc, New York, N. Y.

DISTRIBUTION SYSTEMS can be divided into two broad categories — network and radial. Network systems, comprising a mesh or grid of supply lines, usually have some form of terminal protection in addition to protection at supply transformers Fig 1. Such systems are inherently more expensive per kva of load than radial systems, Fig 2. They are usually justified by improved use of facilities and service continuity and because maintenance is somewhat simpler than on radial lines. Network systems usually find their function in transmission, subtransmission and secondary distribution. Up to now only a very limited amount of primary network distribution has been installed.

Secondary network systems are usually confined to the highly-congested downtown areas of large cities. These systems, (Fig 3) differ from other forms of distribution of polyphase low-voltage in very high load density areas. Loads are more or less continuously tapped on the secondary conductors. In the beginning it was expected that faults on secondary conductors would burn clear without interrupting service. Experience shows most faults are so cleared. Infrequently, however, there are some that continue to burn. Such continued burning is believed to be due to prolonged overcurrent driving off most volatile insulating matter so that little or no deionizing matter or fresh insulation is present in the immediate vicinity of the fault arc. To forestall such rare occurrances some operators have installed sectionalizing fuses in secondary conductors at each junction point. Design of these fuses is an attempt to parallel the time-current curve of the secondary cable; thus the temperature of the cable insulation will be held to a value below that at which rapid and progressive insulation damage occurs. The objective of this protection is to burn the fault clear if possible; if not, then the cable is de-energized between fuses before extensive cable damage occurs. In either form the secondary network system represents the most reliable a-c distribution system so far devised. Its inherent high cost limits its use, however, to concentrated load areas where the upmost in reliability is necessary.

Based on a paper presented before the University of Texas Power Distribution Conference, Austin.

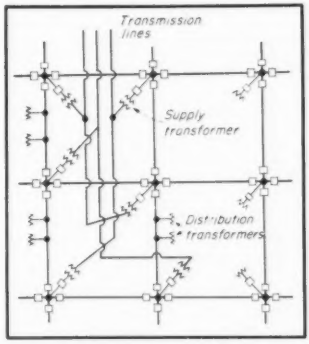


FIG 1—PRIMARY NETWORK consists typically of a mesh of primary tie lines between supply substations. Tie lines have terminal breakers; are topped by radial lines

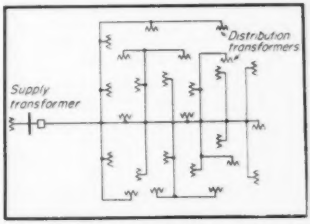


FIG 2—RADIAL CIRCUIT is inherently less expensive per kva of load than a network. Costs are equal only when essentially duplicate radial primary facilities are used

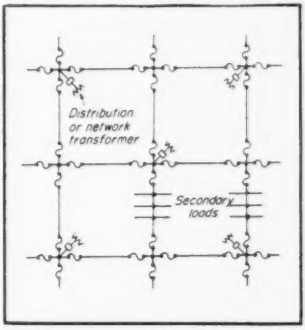


FIG 3—SECONDARY NETWORK loads are continuously tapped from secondary conductors. Inherent high cost limits use to dense load areas demanding utmost reliability

Primary network systems are an attempt to improve the reliability of radial primary systems in medium density areas at a cost lower than that for a secondary network system. The system consists of a number of heavy primary tie lines between stepdown substantions, Fig 1. These tie lines have oil circuit breakers at each end and have radial distribution lines

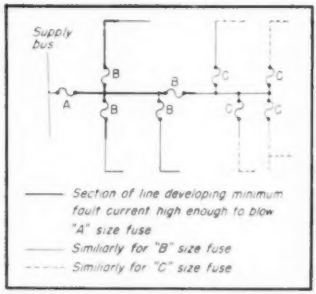

Supply bus
A
B
C
Section of line developing minimum fault current high enough to blow "A" size fuse
Similarly for "B" size fuse
Similarly for "C" size fuse

FIG 4—ELEMENTARY fuse coordination involves fuse at substation of size to handle all safe loads without blowing. Smaller fuses installed at tap and sectionalizing points to protect beyond zone of larger fuses.

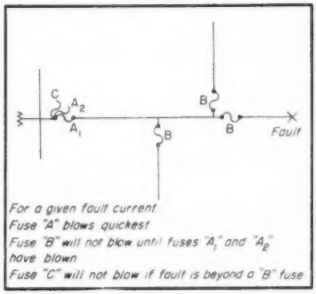

C
A2
A1
B
Fault
For a given fault current
Fuse "A" blows quickest
Fuse "B" will not blow until fuses "A1" and "A2" have blown
Fuse "C" will not blow if fault is beyond a "B" fuse

FIG 5—SELECTIVE COORDINATION with a repeating fuse. Scheme transfers effects of transient faults on single shot line fuses to repeater fuses at substation where attendant may replace links

tapped on throughout their length. A fault on the heavy tie line opens both terminal breakers. The time for clearing the fault is relatively long, in some cases, due to the sequential operation of circuit breakers. Chief advantage of primary network is that continuous, although slightly subnormal, service is maintained upon failure of power supply to a substation. Adjacent substations, supplied by different transmission lines, automatically pick up over the primary tie lines the load of substation lacking power supply. Application of this type of system has been very limited due to its cost, its physical and operating complexity and the disadvantage of slow fault clearing time. Comparisons of radial primary system and primary network system indicate equivalence of cost only when essentially duplicate radial primary facilities are provided.

Because relatively only a small percentage of total power is distributed to the consumer by primary or secondary network systems, this discussion and those that follow will be confined to radial distribution system protection, its problems and some of the solutions which have been effectively used.

Primary Voltage and Load Density

As a point of departure consider the radial four-wire wye primary system having a common neutral multigrounded. Visualize first the effect of load density with different primary voltages. For convenience a circuit will be assumed as having conductor which can economically handle from 200 to 300 amp. If primary voltage is 4.16 kv this implies a circuit capable of handling economically 1,450 kva to 2,170 kva: if the voltage is 13.2 kv it can handle economically 4,580 kva to 6,870 kva. The effect of load density on the miles of lines is indicated in the following tabulation.

TABLE I—Effect of Load Density on Length of Line

Voltage	Density Kva/Mile	Miles of Line 200 Amp Circuit	Miles of Line 300 Amp Circuit
4.16 kv	10	145	217
	20	72.5	108.5
	40	36.2	54.2
	10	458	687
	20	229	343.5
	40	114.5	171.7

Here circuit length ranges from 36 to 700 miles. Such a range is indicative of the protection problem on large distribution circuits.

Rural circuits having more than 600 pole line miles of primary and reaching 60 miles radially from the substation are not unheard of. The range of fault current only 60 miles from a 13.2 kv substation are as follows:

TABLE II—Fault Current on 13.2 kv Circuit 60 Miles Out

Wire Size	Fault Current Amp Phase to Neutral*	Three Phase
No. 6 AWG cu	46	50
No. 4/0 AWG cu	87	172
50% 4/0, 50% No. 6 AWG cu	63	83

*Note: Multigrounded

A 600-mile rural circuit is obviously a low density circuit. An assumed load density of 5 kva per mile gives about 3,000 kva of load or a load current of 131 amp. Since circuit overcurrent protection should not de-energize the circuit for either minor or transient overloads, a setting for overcurrent protection in the range of 250 to 400 amp might be chosen. Compare this 250 to 400 amp overcurrent pickup with the fault currents developed above! Obviously many miles of such circuit cannot be protected by overcurrent protection at the substation. Here, then, is the start of distribution protection problems.

Fuse Radial Systems

Simplest solution for the problem posed is to install fuses at the substation of a size to handle adequately all safe loads without blowing. Then determine either by test or calculation about where minimum faults are no longer cleared in a reasonable time by these fuses. Next install another set of fuses somewhat closer to the substation that are smaller than those at the substation. Several sets of these fuses may be required, i.e. on several branches as in Fig 4. This process may be repeated as many times as needed to attain complete overcurrent protection.

Note that even in this simple case the philosophy of protecting the radial circuit against *overloads* inevitably gives way to a philosophy of protecting against *faults*. The operating level of protective equipment is determined by amount of fault current rather than the amount of load that might be connected to line. This is a fundamental improvement in circuit protection.

This kind of fuse protection is a positive and simple overcurrent protection. However, service continuity suffers. Every transient fault means a substantial outage for some customers until a fuse is replaced. It is for this reason that most protection problems involve the question of how to restore service automatically and quickly.

Use of the three-shot repeating fuse is a logical next step. It will restore service twice and then must be

re-fused. To be completely effective it can only protect a length of line not likely to have more than two faults in any one storm. Moreover it must be inspected at frequent intervals and after each storm. Experience in some parts of the country indicates four miles of line is about right for a three-shot fuse while in other parts where lightning is not so prevalent eight miles of line can be handled.

An interesting and frequently useful fused circuit scheme that may improve service in some minor situations at low cost is illustrated in Fig 5. This scheme is applicable where the distribution lines are not too long and the substation fuse can protect the whole circuit. It consists of a number of single shot branch fuses, called B fuses, and a repeating fuse, at the substation which has the first two fuses of Size A, of such rating that for a fault beyond B fuses the A fuses blow first. The third fuse in the repeater is a C size fuse which for a fault beyond B fuses will blow the B fuses before the C size fuse is damaged. Such a scheme transfers the effects of transient faults on single shot line fuses to the substation fuses where the attendant may replace the A links as they blow. When disabling damage occurs beyond the B fuses the appropriate B fuse blows leaving service on the rest of circuit.

Reclosing Oil Circuit Breakers

When a radial line is supplied through a circuit breaker, the range of protective features becomes much broader than is economically practicable with fuses. Starting with the reclosing aspect a circuit breaker that is manually reclosed is substantially equivalent to a single-shot fuse if we neglect the feature of convenience.

Equipping the circuit breaker with relays to accomplish automatic reclosing in some predetermined sequence eliminates the wide variation in time to accomplish reclosing. But it brings up the question of what sequence of reclosures will produce most desirable results. Some early automatic reclosing circuit breakers reclosed 15 sec after tripout and if fault persisted they reclosed 30 sec later. If fault still persisted the breaker once more reclosed, 75 sec after preceding tripout. Experience with this reclosing sequence established the fact that most faults are transient. When the circuit was deenergized for an interval the fault cleared itself and service could be restored by re-energizing the circuit. There were relatively few cases where the second reclosure successfully restored service and even fewer where the third reclosure did any good.

With most faults cleared by the first reclosure of the breaker the question arises; "Why wait 15 sec to reclose the first time? Perhaps by reclosing immediately service can still be restored in most cases and motors will not appreciably slow down." Experience proved this to be the case with result that immediate reclosing further improved service. With breakers in the 5 to 15 kv range equipped with conventional reclosing mechanisms it was possible to restore service in $\frac{1}{4}$ to $\frac{3}{4}$ sec. Efforts to reduce this time below $\frac{1}{4}$ sec have not been popular due both to difficulty with arc path of the fault not deionizing fast enough and to the considerably increased cost of faster reclosing mechanisms. With such rapid restoration of service there is considerably less need for the self clearing feature in lightning protective devices, thereby broadening the application of plain spill gaps.

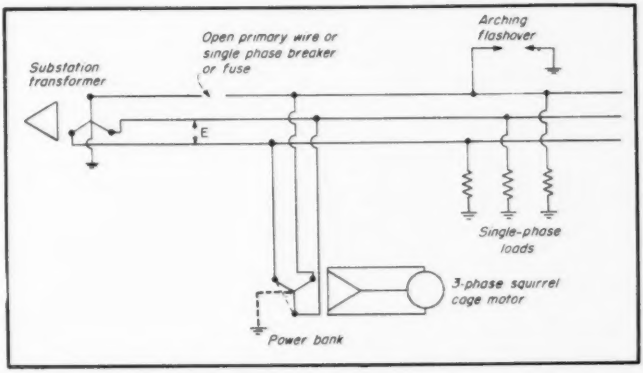


FIG 6—EFFECTS OF LOADS and transformer connections on single-phase switching. When power bank neutral is grounded it becomes a grounding band and tends to maintain voltage on the open phase. If power bank is ungrounded three-phase motors may operate as phase converters to maintain three-phase voltage

It should not be inferred that immediate reclosing can be applied indiscriminately to radial circuits with good results. Where there are substantial amounts of synchronous motor load or of induction motor load and power factor correction capacitors, the energy stored in the rotating machinery may sustain the circuit voltage and the fault arc during the $\frac{1}{4}$ to $\frac{3}{4}$ sec that the circuit breaker is open. Under such conditions the circuit is still in trouble when the circuit breaker closes and no good has been accomplished by rapid reclosure. There are several remedies:

1. Make the interval before reclosure long enough for the load to absorb the stored energy and collapse the voltage.

2. Provide a separate switch to short circuit the line for an interval of time and thereby dissipate the stored energy in line loss.

3. Automatically disconnect the offending motors upon reversal of power flow.

Other means may occur to the reader.

If the circuit breaker consists of three electrically and mechanically independent single-pole circuit breakers or other single-pole devices, either motor load or transformer connections may act to sustain voltage on a faulted phase during the period the faulted phase circuit breaker is open as shown in Fig 6. If the power

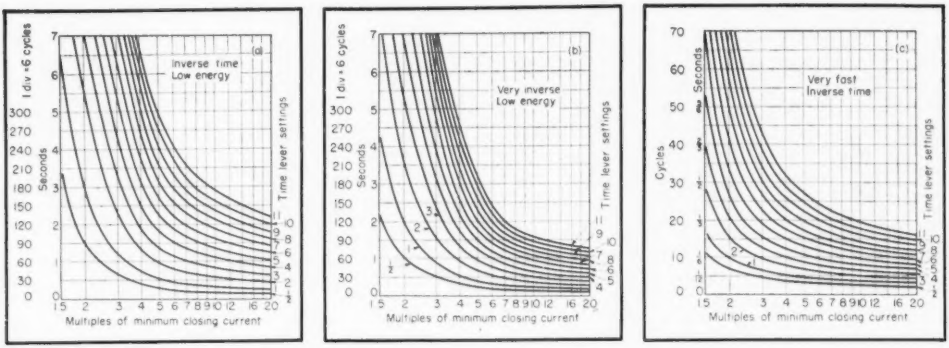
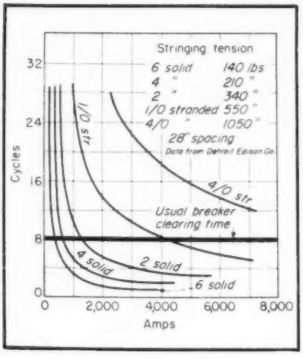


FIG 7—TIME-CURRENT CURVES of three types of induction relays: (a) Inverse time low energy, (b) Very inverse low energy and (c) Very fast inverse time. Relay with suitable overcurrent characteristics provides selectivity between cascaded protective units.

bank neutral is grounded it becomes a grounding bank and attempts to maintain voltage on the open phase.



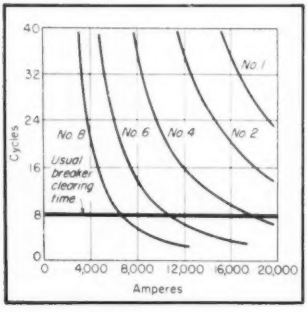


FIG 8—BURNDOWN characteristics of weatherproof copper wire under tension (top) and bare unstressed copper wire (bottom). For a given fault current weatherproof wire burns down quicker than bare wire. Reduced breaker clearing time offers methods of reducing occurrences of burndown

If the power bank neutral is not grounded the three-phase motors may operate as phase converters to maintain three-phase voltage. Magnitude of these effects is largely determined by relative size of power bank or three-phase motors and remainder of circuit load. Partly for these reasons and partly because of cost, single-pole automatic rapid reclosing substation circuit breakers have not been generally used on three-phase distribution lines.

Tripping

Early circuit breakers used instantaneous over-current relays to initiate tripping. Transient overcurrents often tripped such circuits unnecessarily. To overcome this, dashpot time delay was added. But erratic performance of dashpot time delay relays made them unsatisfactory where accurate timing was necessary for selectivity. This need led to development of the induction overcurrent relay which today is the backbone of radial circuit protection.

Induction overcurrent relay provides tripping at definite and known values of current and time. Within limits, shape of the time-current characteristic curves are subject to control of relay designer. Time current curves of three types of induction relays are shown in Fig 7a, 7b and 7c. By use of a relay having appropriate overcurrent characteristics it is often possible to obtain selectivity between several cascaded protective devices: (1) The substation circuit breaker, (2) a line fuse, (3) a branch fuse and (4) transformer fuse.

In applying induction overcurrent relays on radial distribution circuits the effect of relay time on conductor damage should be considered. Time for a stable arcing fault to soften weatherproof, covered copper conductor enough to cause it to break is shown in Fig. 8. Unlike the stable arc occuring on weatherproof wire, which usually stays in one spot, the arc resulting from flashover of bare conductors may be free to move away from the source of power. In one instance an arc was photographed moving along a line at 60 mph. Time current fusing curves for unstressed bare copper wire are shown in Fig 8. These fusing currents are considerably higher than the weatherproof wire burndown currents.

It is reasonable to believe that when an arc stays in one place, burndown current of stressed bare wire is lower than the fusing current of unstressed bare wire. Thus the bare stressed wire burndown curve lies between the stressed weatherproof burndown curves and the unstressed bare wire fusing curves. It is sufficient to observe that for a given fault current arc, weatherproof wire burns down quicker than bare wire. Moreover, it is found if much relay time is added to the eight-cycle breaker clearing time, No. 6, No. 4 and No. 2 weatherproof copper will burn down on all faults of more than 500 amp.

(To be continued)

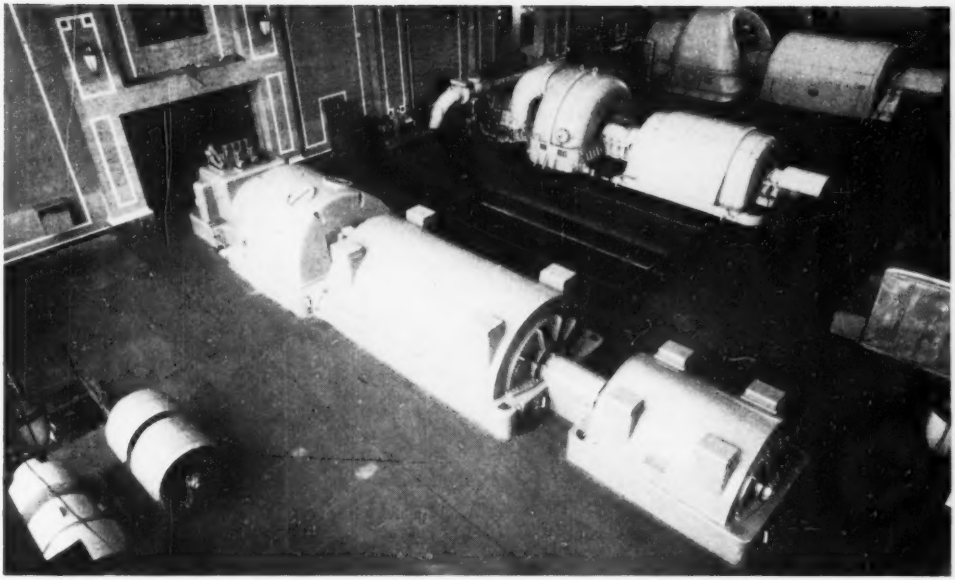


FIG 1—LATEST ADDITION at Essex Station is the turbine-generator unit (front) rated 100,000 kw, 3600 rpm, 13.8 kv, 3 phase, 60 cycles; steam conditions at throttle, 1250 psi, 1000 F. To the rear and across floor opening is a duplicate of replaced 22,500-kw unit

Essex Unit Auxiliaries Safeguarded By Shaft Generator and Dead Throwover

100,000-kw unit has shaft-driven house generator and motor-driven exciters . . . Center-tap reactor utilized to limit breaker duties . . . Indoor generator leads are copper bars in rectangular configuration

E. H. SNYDER
Asst. Chief Engineer
Electric Engineering Dept
Public Service Electric & Gas Co
Newark, N. J.

THE LATEST and largest generating unit at Essex Generating Station is of particular interest because its installation effected a considerable increase in capacity and economy by the replacement of 30-yr-old equipment within the original station building. A single 100,000-kw, 3600-rpm, turbine-generator (Fig 1) and a single 900,000-lb-per-hr boiler, operating at 1250 psi, 1000 F replaced a 22,500-kw turbine-generator and four small boilers, installed in 1915 and operating at 225 psi, 500 F.

A low unit cost was obtained (1) because of the simplicity of the unit system and (2) because it was possible, at this station, to make maximum use of the existing building foundations, circulating water tunnels, and fuel handling facilities. Furthermore, no additional transmission or main transformers were required to connect the new unit into the system. The average annual heat rate of the new unit was about 10,500 Btu per net kwhr during the first year of operation, as compared with more than 20,000 Btu for the unit it replaced.

Essex Generating Station, located on the Passaic River at Newark, N. J., was built originally as a 225-psi station in three steps, in 1915, 1913, and 1924. There were six main turbines, totaling 193,000 kw, served by 24 stoker-fired boilers. In 1937 and 1938 the station was modernized by the installation of two 605,000-lb-per-hr, 1250 psi, 950 F boilers and a 50,000-kw superposed turbine. The new 100,000-kw unit increased the station capacity to 243,000 kw and the system capacity to 1,211,150 kw.

Adapted from a paper presented before Electrical Equipment Committee of Edison Electric Institute

Fig 2 is a plan view of the boiler-turbine installation at the operating elevation. The installation has centralized control with the panels located about equidistant from the boiler and the turbine. The auxiliary substation buses also are located on two elevations in this area, which is the ideal point from the standpoint of distribution layout. Control of the 13-kv switches and the 2300-v auxiliary bus supply is located in the main station control room.

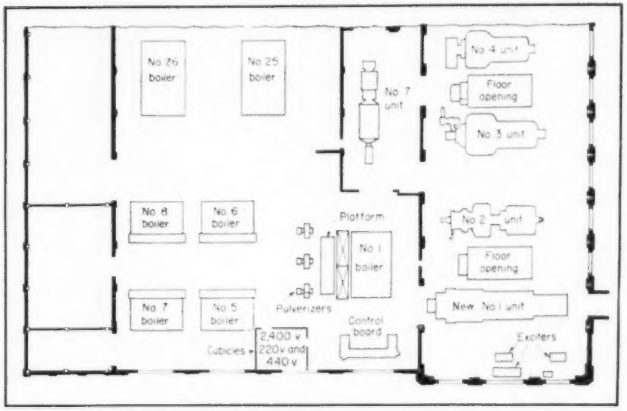


FIG 2—BOILER-TURBINE INSTALLATION at operating elevation

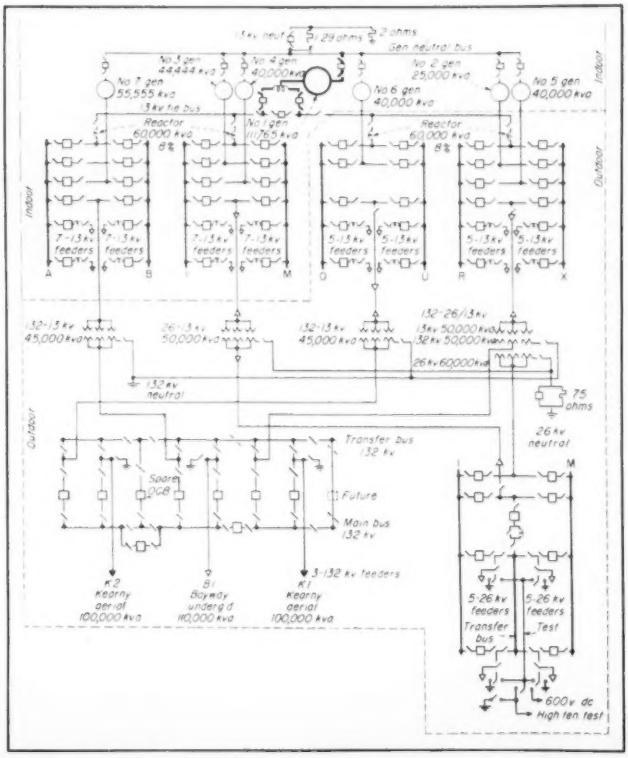


FIG 3—MAIN BUS DIAGRAM shows how 100,000-kw unit is connected into 13-kv tie bus

The 100,000-kw turbine and boiler are just about the largest units which could be located in the space available. In all high-pressure boiler installations made since 1937 at Public Service stations, precipitators have been located outdoors above the roof. In this case, the trend toward outdoor construction has been carried a step further by installing the air heaters and forced and induced draft fans above the roof.

The boiler-turbine-generator combination is designed to operate as a unit, entirely separate from the other machines in Essex Station. All the new auxiliaries are carried by an auxiliary generator, except during the starting-up period. The transfer of auxiliary buses from the starting transformer to the auxiliary generator, and vice versa, is accomplished by dead throwover. Experience with operating errors in paralleling multiple sources of auxiliary supply indicates that the dead throw-over method should be more satisfactory.

Turbine-Generator

The turbine-generator purchased for this project is a 3600-rpm single-shaft machine, having a hydrogen-cooled main generator rated 95,000 kw, 111,765 kva (85% power factor), 13,800 v at 15 psi hydrogen pressure, and 95 F cooling water. This generator may be operated at 25 psi hydrogen pressure, under which condition its rating is increased to 117,647 kva. The air-cooled house generator, coupled to the main shaft, is rated 7,500 kw, 9.375 kva, 2400 v, which is somewhat greater than the total auxiliary load. It has ample capacity to stand the transfer of large blocks of auxiliary motor load from the starting-up transformer. Both generators are spring-mounted to minimize the effect of 120-cycle vibration, and both machines have vertical cooling units.

No transformers or new transmission circuits were required to make this new capacity available on the system. Fig 3, a one-line diagram, shows how this machine was connected into the 13-kv tie bus between

the indoor and outdoor groups. In order to limit breaker duties to 1,500,000 kva, it was necessary to utilize a center-tap reactor having an impedance of 14.07% for through-faults and 4.58% on one leg, but presenting only 1.40% impedance to the normal balanced load current. Three 4,000-amp oil circuit breakers are installed; two connect the reactor leads to the bus while the third serves to close the tie bus when the machine is out of service. All of this equipment is located out-of-doors between the turbine room and the switch house.

Generator Leads

This being the first machine on the system having an output of as much as 5,000 amp per phase, considerable study was given to the design of the generator leads (Fig 4). From the machine bushings to the building wall, a distance of 50 ft, the leads are enclosed in ventilated Transite compartments. Company practice has been to insulate all machine leads indoors with full voltage conductor insulation in addition to full voltage porcelain bus supports. Because of the heavy current, insulated copper tubing was impracticable from the standpoint of heat dissipation. A ventilated, insulated conductor arrangement was designed for this application. It consists of four $\frac{1}{2}$ x 5-in. flat copper bars, insulated with $\frac{1}{8}$-in. Micarta and mounted on 23-kv bus supports by means of special clamps. Outside the building, the buses consist of bare 6 x 6 x $\frac{1}{4}$-in. ventilated square copper tubing for the 5,000-amp runs, and 4-in. I. P. S. extra heavy round tubing for the 4,000-amp leads from the reactor legs to the point of connection with the existing tie-bus.

Auxiliary Supply

This generating unit operates entirely independent of the existing auxiliary supply system of the station. All of the auxiliaries for this unit are electrically driven. The maximum auxiliary load is 6,000 kw and this is normally supplied by the 7,500-kw house generator.

A 3-phase, 13.2—2.4-kv transformer, nominally rated at 4,000 kva but capable of carrying 6,000 kva with fans under summer ambient conditions, is used for starting and emergency supply to the auxiliaries. The auxiliaries are divided into three 2400-v bus groups, with the motor-driven exciter set constituting a fourth (Fig 5). Each of the four group buses may be individually connected to either the auxiliary generator or the auxiliary power transformer, but the breakers are interlocked electrically to prevent the paralleling of the generator with the transformer.

This means that each group is subject to a momentary interruption when transferring from the transformer to the house generator, or vice versa. When transferring manually, the control room operator trips one breaker, watches for the green light showing that the breaker is in the open position, and then closes the other breaker. To insure that the second breaker does not close in with too high a residual flux in the motors, which could result in an abnormally large inrush current and undue mechanical forces on the motor windings, a voltage relay is connected to each of the four groups. By this means the bus voltage due to residual rotor flux is allowed to fall to a safe value before the second breaker can be closed.

Exciter Group

In the case of the exciter set, the voltage relay functions when the motor voltage has dropped to 1000 v, which results in a de-energized time interval of about 85 cycles. The other buses feeding auxiliary motors have their voltage relays set to operate when the residual voltage has fallen to 500 v, which also results in a de-energized interval of about 85 cycles.

In the event of loss of voltage on the auxiliary generator, the groups are automatically transferred to the transformer source. On reduction of voltage to a predetermined value, throwover is by the so-called "voltage chaser" method actuated by an induction type undervoltage relay. In case the auxiliary generator differential protection operates, the multi-trip relay actuated by the differential relays makes the throw-over without waiting for the voltage chaser. Inasmuch as the transformer source will be used only in starting and shutting down the boiler-turbine unit or when for any reason the auxiliary generator is unavailable, no automatic means are installed to throw over from the transformer source to the auxiliary generator rated 9,375 kva.

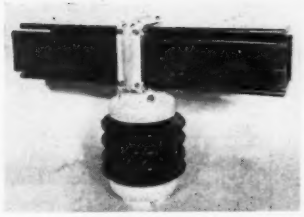


FIG 4—VENTILATED, insulated 5,000-amp, 13-kv indoor generator lead

For certain auxiliaries 440-v buses supply motors from 20 to 200 hp in size, and the 220-v buses feed motors up to 20 hp in size. Two sets of 440-v and 220-v transformers are provided, each of the two pairs being supplied by a single 2400-v circuit breaker connected to a different 2400-v bus section. No ties are provided between the 440-v and 220-v buses supplied from these separate sources, but light ties are provided to two 220-v buses from one of the old auxiliary substations in order to take care of lighting and essential small motors such as the turning gear and oil pump motors, which must continue to operate when the unit is shut down.

The auxiliary power transformer is located outside the boiler house wall. Adjacent to this and behind wing walls are located the 440-v and 220-v transformers. The auxiliary buses are directly inside this building wall, which results in very short transformer leads. All of the auxiliary circuit breakers are of the magnetic blow-out, draw-out type, mounted in cubicles. The 440-v and 220-v cubicles are located adjacent to the 2400-v cubicles from which they are supplied. Each of the three 2400-v buses is located in a separate ventilated room.

In order to minimize the number of 2400-v breaker cubicles required, each of the three pulverizer and pulverizer exhauster motors is paralleled on a single position, as are the two forced and induced draft fan combinations.

Auxiliary Drive Motors

Several of the 2300-v motors are of the totally enclosed type, having design features of particular interest. Squirrel-cage, 1750-hp, 3600-rpm

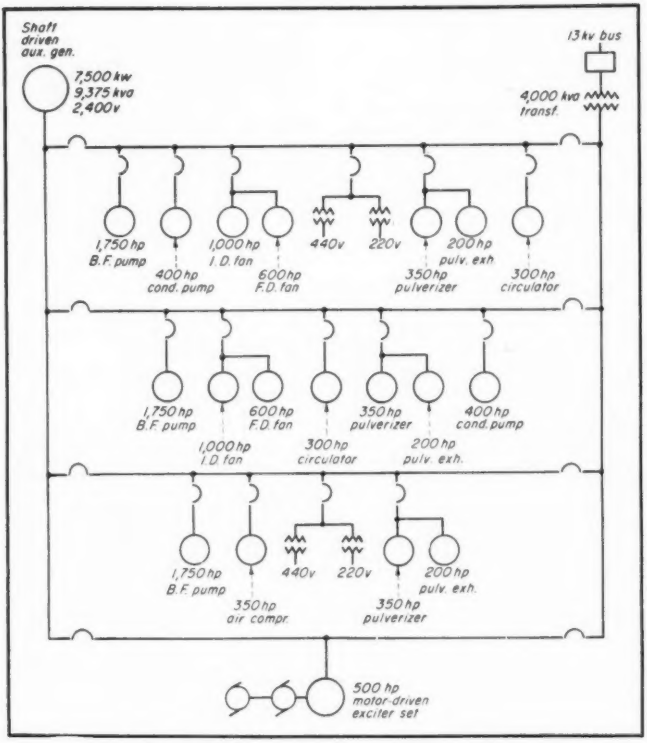


FIG 5—AUXILIARIES are operated from a four group, 2400-v bus arrangement

motors drive the three boiler feed pumps through hydraulic couplings which provide variable speed control.

The boiler is equipped with two sets of forced and induced draft fans mounted on the roof. It was considered necessary to use totally enclosed motors for outdoor service, because of troubles which had been experienced with open type motors operating outdoors. The two induced draft fan drives are silicone-insulated, copper fin-cooled, squirrel-cage motors, rated at 1,000 hp, 600 rpm.

The forced draft fans are driven through hydraulic couplings by 600-hp, squirrel-cage, 1200-rpm totally enclosed fan-cooled motors. These motors have built-in tube type heat exchangers between the inner and outer air circuits.

Generator Fault Protection

The main generator is relayed for internal faults by one high-speed, 3-phase, type HA differential relay; all 13-kv leads and buses to which the generator is connected are protected by type CA-6 differential relays. Twelve imbedded temperature detectors dispersed throughout the stator coils are connected to a Micromax recorder to provide an alarm when the winding temperature exceeds 105 C. Over and undercurrent relays in the field circuit sound alarms for a 5% overcurrent or for a current less than synchronizing value. Maximum field current of 150% is limited to 1-min operation. An out-of-step relay is considered unnecessary, since the machine is so closely linked to the rest of the station. Provision is made for connecting the generator neutral to the station ground bus; however, normally only one machine in the station is operated grounded.

The 2400-v auxiliary generator connected in wye is similarly relayed and thermally protected; the neutral, however, is connected to ground through a separate 3-ohm resistor. An overcurrent relay in the neutral provides backup ground protection. All 2400-v leads and buses to which the generator is connected are also protected by CA-6 differential relays.

The grounded wye connection of the auxiliary generator permits the use of one type COH ground relay on all 2400-v motors in addition to two type CO relays with instantaneous trips for phase-to-phase faults. These motors are also equipped with high-temperature alarms set at 95 C.

Excitation

Because of commutation trouble experienced with 3600-rpm shaft-driven exciters and gear trouble with half-speed geared exciters, it was decided at the outset that excitation would be provided for both main and auxiliary generators by a separate motor-generator set. This unit consists of a 500-hp, 900-rpm, squirrel-cage motor driving a 300-kw, 250-v main generator exciter and a 40-kw, 250-v auxiliary generator exciter. Main generator voltage adjustment is by means of a rheostat in the exciter field, with automatic regulation provided by a 3-kw amplidyne set. Voltage control on the auxiliary generator is by means of a rheostat in the auxiliary exciter field and an automatic voltage adjuster.

To minimize the voltage dip on the auxiliary generator resulting from transfer of the auxiliary buses from the transformer to this generator, the auxiliary generator voltage is raised manually about 10 to 15% before the throw-over is made. An incidental advantage of having a separately driven exciter, which was not anticipated at the time the machine was purchased, is that it provides a convenient means of preheating the main generator field. In starting up on a normal schedule a preheating field current of 800 amp is applied when the machine speed reaches 800 rpm. Field tests of differential copper to iron expansion have been made and on the basis of these data it is expected that the manufacturer will establish a series of field current values for preheating with various starting schedules.

The turbine-generator has met its performance guarantees and has proved satisfactory in operation. It has carried a maximum load of 118,500 kw on test and is regularly operated at a loading of 110,000 kw.

HOW TO DESIGN • CONSTRUCT OPERATE • MAINTAIN

Hot Insulator Washing Now Routine On 287.5-Kv

T. M. BLAKESLEE
Los Angeles Department of Water and Power

WASHING INSULATORS on energized 287.5-kv lines has become a routine operation for the Los Angeles Department of Water and Power. Lower voltage circuits have for many years been washed while energized, but initial washing of 287.5-kv circuits was performed with lines deenergized. Following a series of tests demonstrating safety of the work, however, the lines have been washed while in service.

Photos by M. M. Phegley

INSULATOR WASHING TRUCK with connecting hose to pipe riser on double-circuit tower of Los Angeles Dept of Water and Power's Hoover Dam-Los Angeles 287.5-kv line.

High Pressure Water Used

In 1929 the Department carefully tested performance of dust-contaminated insulators in fog-laden atmospheres. These tests demonstrated that production of a trouble-free line insulator for such service would be difficult to obtain. The tests also showed that operating problems would be solved by keeping insulators clean. To this end high-pressure water-stream washing of insulators was developed. It has been used successfully for the past twenty years to combat dust and fog problems on line insulation.

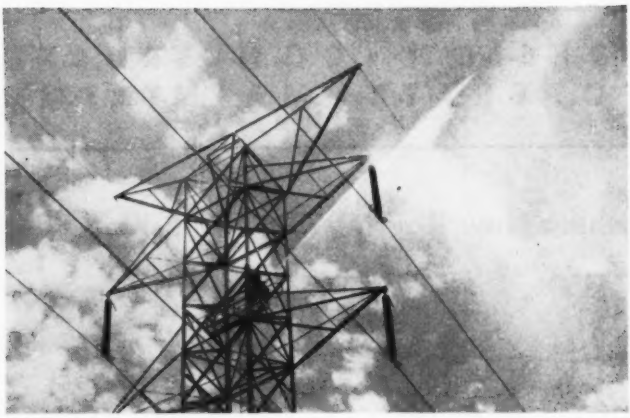
Part of the double-circuit section of the 287.5-kv lines from Hoover Power Plant to Los Angeles is subject to severe contamination. It passes through areas in and adjacent to the city, where extended dry summer periods are followed by heavy fogs. In these areas periodic high-pressure water-stream washing of line insulators while energized is now routine. It allows both circuits of the double-circuit section to be washed with one climbing of the tower, saving considerable time. The 287.5-kv circuits are washed every six months unless unusually severe conditions dictate a change of schedule.

To facilitate washing operations permanent copper pipe risers have been installed on many of the double circuit towers. The risers have hose connections at the proper levels for washing the insulators on the cross arms. Therefore only a short section of high-pressure hose with the directing nozzle need be handled on the tower. This greatly expedites the work on each tower. A hose connection from the insulator washing truck to the bottom of the riser at the base of the tower completes the water circuit. A pump capable of delivering 50 gpm at 1,000 psi is mounted on the truck. The high pressure is required for satisfactory operation on towers which range from 150 to 225 ft high.

Considerable water is required to do a thorough job at each washing. The insulator washing truck carries a 500-gal. tank. A 1,200-gal tank truck shuttles between the washing location and the nearest water hydrant to keep the truck constantly supplied. About 800 gal are required on the average to wash all 24-unit insulator strings on a double-circuit suspension. About 1,500 gal are required on a double-circuit dead-end tower.

Resistivity of Water is Checked

In districts outside the City of Los Angeles arrangements are made to purchase water from the local serving utility in the area. Resistivities of the water supplies are checked with a convenient portable instrument

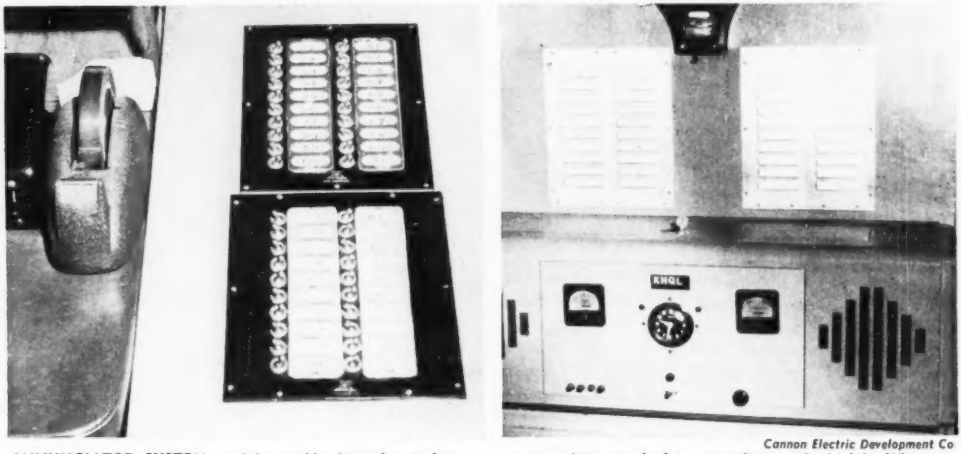


PATROLMEN washing insulators on energized 287.5-kv circuit. Washing point is just below conductor so stream can be directed to under sides of insulator units. Washing progresses upwards on the string after first directing water stream to bottom insulators

made especially for the purpose. This instrument obtains its a-c supply for the resistivity measurements through a vibrator operating on the regular truck storage battery. Hydrant water generally runs about 1,500 to 3,000 ohms per centimeter cubed; anything above 1,000 ohms is considered satisfactory for the washing operation.

The washing crew for the 287.5-kv circuits consists of a foreman, two line patrolmen, two assistants and a driver for each of the two trucks. An additional patrolman is usually needed when washing insulators on towers not yet equipped with pipe risers. The additional work of handling long sections of hose in the tower structure requires the extra manpower.

Annunciator Simplifies Radio Dispatcher's Work



Cannon Electric Development Co

ANNUNCIATOR SYSTEM used by trouble dispatcher to keep track of radio cars makes it unnecessary to rely on notes or memory. Control panel switches (left) illuminate numbers of cars in service on annunciator panel above on radio console (right). When car operator checks out, dispatcher snaps off light. Having been enlarged once, annunciator will be added to again in the near future

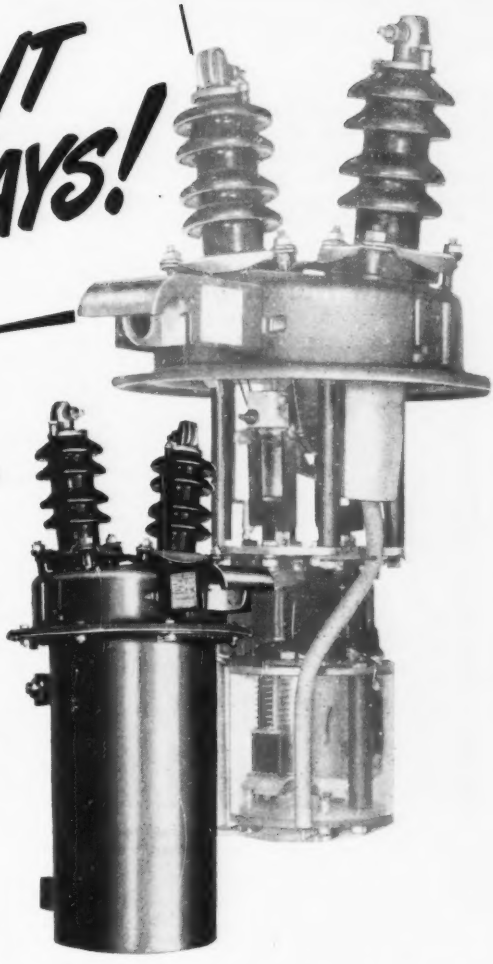
CECIL I. HOGAN
Distribution Superintendent
Little Rock Division
Arkansas Power & Light Co
Little Rock

EVEN WHEN IT'S QUIET a trouble dispatcher has his hands full when he is handling calls from a city of 100,000 and several small towns, dispatching trucks and cars by radio, and trying to remember which cars are in service and which are not. But in addition, the Little Rock Division dispatcher for the Arkansas Power and Light Co has two f-m radio sets, two microphones and two consoles to operate. One console was the main station KHQL, the other, a control circuit operating a relay radio station five miles away.

To lighten his task and help him keep track of cars that are in and out of service with as little effort as possible, the annunciator system, shown, was installed. It is similar to registers used in hospitals.

The control switch panel is in easy reach of the dispatcher, on a level with his desk. The annunciator, with illuminated numbers, is on the wall above one radio console, out of the way but in easy visual range of the

COMPARE IT THREE WAYS!



The FR-1 Relayed Automatic Recloser

1 FOR MINIMIZING OUTAGES

Fuses and conductors are protected by instantaneous first and second operations—very fast openings—regardless of ambient temperature, viscosity or condition of oil.

- False operations are prevented by precision timing—plus relay control of the interrupter—and, again irrespective of temperature or oil.
- Re-setting is 5- to 15-times faster than other types of reclosers—protecting against rapidly recurring temporary faults, even successive line flashovers by lightning strokes seconds apart.
- Inrush current cannot instantaneously retrip recloser.
- Fewer outages on every score.

2 FOR ECONOMIES IN MAINTAINING SERVICE

Fewer outages mean, of course, fewer service trips. Moreover the unavoidable outages can be located more quickly and service restored in less time.

- With the FR-1, many series fuses can be used to further sectionalize the system with permanent faults always confined to a minimum number of consumers. As many as 4 to 7 different ratings of fuses can be reliably co-ordinated with each rating of recloser because of the established minimum and maximum characteristics of the recloser and year-round accuracy.

3 FOR ENDURANCE IN SERVICE

Oil Blast interruption of arc in $\frac{1}{2}$ cycle means longer life—minimum wear of arc-resisting Elkonite contacts and minimum carbonization of oil.

- Gears of heavy-duty escapement timer are case-hardened and plated. Timer operates in air above the oil, for lasting fidelity of timing and independence from temperature changes or viscosity of oil.
- Coils will withstand continuous current up to two times rating (up to minimum pickup current) without damage—unexpected overloads can't hurt the coils.
- Built-in Thyrite valve element by-passes lightning and surge voltages—protects turn insulation of coils.

Bulletin GEA-4934 describes in detail this unique recloser, gives data on co-ordination with fuse links and tells about its "locked-closed" alternate operating function (convertible in the field) which simplifies and extends co-ordination with fuses. For your copy address your G-E Apparatus Sales Office or write *Apparatus Dept., General Electric Company, Schenectady 5, New York.*

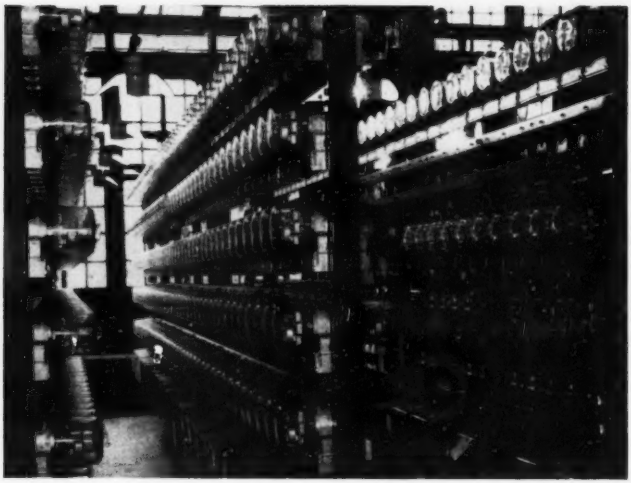
GENERAL ELECTRIC

operator seated at his desk.

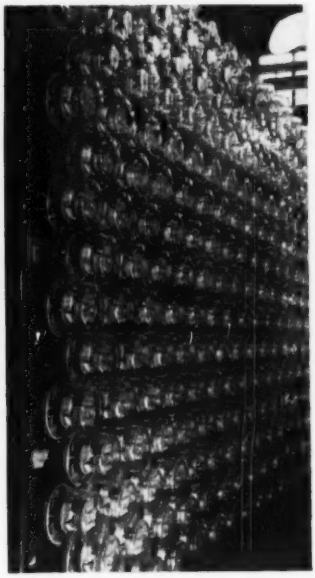
On checking a car into service a small switch on the control panel is snapped on, lighting the car number on the panel. This shows that the car is in service and the operator available on the radio. When the car is taken out of service, its operator checks out with the dispatcher who then snaps the switch off, darkening the car number and showing that it is no longer available by radio.

Before this system was installed the company had fewer radio-equipped cars and the area covered was smaller. Yet it was hard even then to remember or write notes on the few cars that had radios. Today it would be impossible to keep track of the cars either with pencil notes or memory or both. But the annunciator system does the job wonderfully. It has been enlarged once and will be enlarged again in the near future.

New Meter Storage Racks Hang All Types of Meters



SAME METER RACK as shown above has been adapted to hang 468 terminal type meters and 48 of the large graphic type by changing the hanger pins



A TOTAL OF 976 socket meters can be mounted on meter rack which is 8 ft high, 27½ ft long. Removable pins add flexibility

E. L. KELLER
Superintendent
Meter Division
Duquesne Light Co
Pittsburgh, Pa.

METER STORAGE is an old but important problem that has a habit of forcing itself upon the attention of utility meter divisions as the number of meters increases and as space becomes more limited.

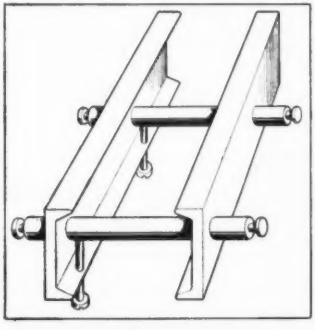
New meter storage racks have recently been designed and installed at the Duquesne Light Co, Pittsburgh. The method of construction used has not only saved space but also resulted in flexible storage racks that facilitate meter handling and in addition are neat and attractive.

The basic rack is built of 2-in. steel pipe vertical supports and horizontal 2-in. steel channel members. It is 8 ft high and 27½ ft long.

Two different views of the basic rack are shown. One view shows the rack carrying 468 terminal-type meters and 48 large graphic type meters. The other view shows the same rack rearranged to accommodate 976 socket type meters.

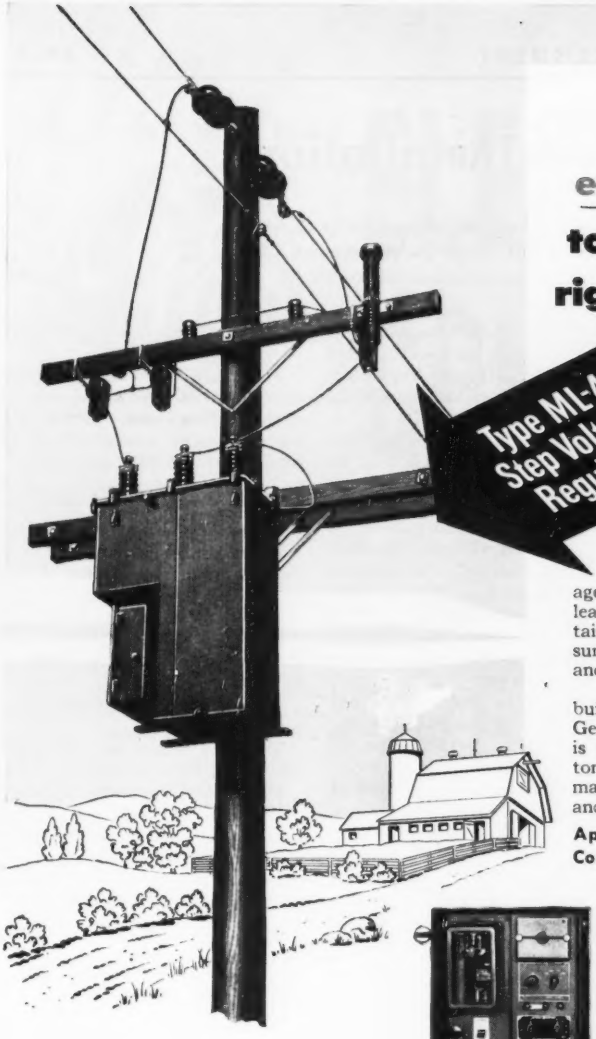
Pins Make the Difference

The difference between the two lies only in the removable pins on which the meters are hung. These pins, which are made of ½-in. steel rod, are held in place in the horizontal steel channels by set screws as shown in the sketch. Only three types of pins are needed to hang any type meter used by the company. The pins differ in length and shape of head for the various types of meters. Pins were manufactured by a local machine shop on an automatic screw machine at a very reasonable cost ($0.11 each).



REMOVABLE PINS of three different lengths and shapes of head hang any type meter used by comapny. Pins made from ½-in. steel rods pass through horizontal channel members; are secured by set screws

Here's the economical way to keep voltages right on rural lines



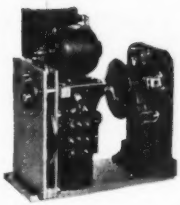
In rural service especially, voltage regulators provide the simplest, least expensive method for maintaining proper voltage to all consumers—for insuring more revenue and fewer complaints.

For a service-proved regulator, built specifically for rural lines, use General Electric's Type ML-4. It is a single-phase step-type regulator—provides ten per cent automatic voltage regulation at low cost, and with minimum maintenance.

Apparatus Dept., General Electric Company, Schenectady 5, New York.

DEPENDABLE, AUTOMATIC CONTROL—

Voltage regulating relay, motor control relay, and other elements of the control panel are similar to those in the more expensive type of induction regulator used at urban sub-stations and important load centers.

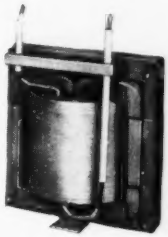


THE SWITCHING MECHANISM—

Shockless, snap-action, Geneva drive assures accurate positioning of contacts and long life. A tap change is completed in 1½ cycles. The complete mechanism operates under oil and requires no lubrication.

SPIRAKORE CORE AND COILS—

The regulating transformer used in the ML-4 step voltage regulator is of Spirakore design—similar to the famous G-E Spirakore distribution transformer, with the flux through the core following the grain direction of the steel, giving smaller size and lighter weight.



GENERAL ELECTRIC

Lightning Arrester Installations

An adaptation from construction standards of Consolidated Gas Electric and Power Co of Baltimore, Md.

A GUIDE is presented for arrester locations and ratings, also sketches showing installation arrangement for line type arresters 6 kv to 37 kv.

Location of Arresters

Lightning arresters are installed for the protection of equipment at the following locations:

1. Transformers — Each conventional type transformer should be protected by a lightning arrester located on the transformer pole except in cases where there is no overhead primary exposure.

Booster transformers should be equipped with arrester protection on both the line and load sides.

Constant current transformers require arrester protection on both the primary and secondary sides.

Street light circuit transformers are always protected by arresters on both primary conductors. Arresters are installed on the secondary side at locations designated by the office.

2. Switches (Oil or Air Break) —Switches which are normally closed can be protected against lightning by one set of arresters. Switches that are normally open require arrester protection on both sides of the switch.

All lightning arresters installed for the protection of a switch must be located on the switching structure.

3. Underground Terminals — Lightning arresters are placed on each underground cable terminal pole that is connected to an overhead feeder or street light circuit. Cables that extend from an underground pole to a customer's substation or vault should be equipped with arresters at each end.

4. Regulators—Voltage regulators are protected on both the line and load sides by arresters located on the poles of the regulator bank.

5. Metering Units—Each side of a metering unit that has an overhead primary exposure requires the protection of lightning arresters located on the same pole as the metering unit.

6. Capacitors—Capacitors are protected by a set of arresters mounted on the same structure.

Arrester Installation

The arrester ground should consist of one or more ground rods having a ground resistance when tied together of 25 ohms or less.

Since the bottom of an arrester often blows out when the arrester fails, the ground connection should be formed so that no pressure will be placed on the arrester bottom that might interfere with this dropout action.

Arrester Ratings

3000-v arresters should be used on the 4150-v system.

6000-v arresters should be used on the 6600-v system.

12,000-v arresters should be used on the 13,000-v system.

25,000-v arresters should be used on the 26,000-v system.

37,000-v arresters should be used on circuits with ungrounded neutrals on the 33,000-v system. Circuits having a grounded neutral should be equipped with 30,000-v arresters.

Series Street Lighting Circuits

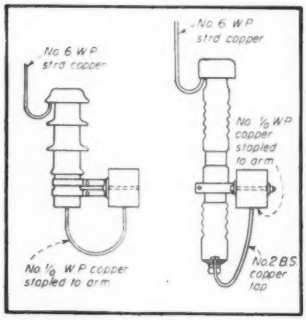
The rating of arresters installed on any part of a series circuit fed by a constant current transformer should be based on the size of the constant current transformer. On a 6.6-amp circuit fed by a constant current transformer, the arrester ratings would be as follows:

15-kva or smaller cc transformer, use 3000-v arrester.

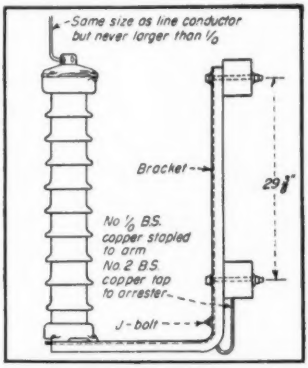
20 kva to 30 kva, use 6000-v arrester.

40 or 50 kva, use 12000-v arrester.

Above ratings hold good for the arresters on primary side of street light circuit transformer. The secondary side of street light circuit transformer is equipped with 3-kv arresters where necessary.



AUTOVALVE type arrester (left) rated 6 to 15 kv. Pellet type arrester (right) rated 6 to 15 kv


Same size as line conductor but never larger than 1/0
Bracket
29"
No. 1/0 B.S. copper stapled to arm
No. 2 B.S. copper top to arrester
J-bolt

AUTOVALVE and thyrite arresters rated 20 to 37 kv

Note: Use hot-wire clamps for connecting arresters to 13-kv, 26-kv and 33-kv lines

Any trade names and manufacturer's catalog numbers used in identifying items or materials are for descriptive purposes only, and equivalent articles produced by other firms are acceptable.

New... ELECTRIC CONNECTORS

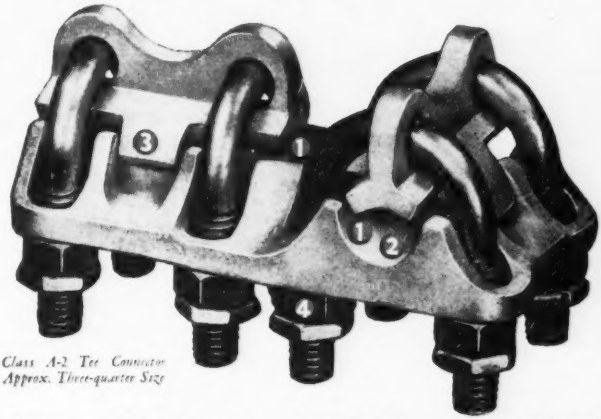
A complete new line of connectors that will simplify your stock problems, reduce system maintenance costs and give you reliable service

1. Serrated contact surfaces **are used on all Class A-1 and A-2 connectors to give extremely high pull-out strength. The connectors are designed to give a permanent, high-conductivity joint that will resist vibration and give positive pressure on the cable at all times.**

2. Silver contact surfaces **are a standard feature on *all* General Electric connectors for use with copper conductors. This eliminates oxidation problems, assures lower contact losses, low maintenance, and long life.**

3. Interlocking sides **on all Class A-2 and A-1 connectors confine the strands of the cable within the conductor enclosure, thus obtaining full advantage of the cable's current-carrying capacity.**

4. Non-corrodible hardware **is of high-strength bronze alloy that gives tight and trouble-free service. These connectors can be installed without removing nuts from the clamps; thus eliminating the trouble of lost nuts and washers. The connectors will not twist, distort, or season crack.**



Class A-2 Tee Connector
Approx. Three-quarter Size

Correct material for the job means that the composition of the metal alloy used is scientifically varied depending upon the application of the connector. For instance, the copper content is accurately regulated so that the connector carries current equal to the maximum current-carrying capacity of the conductor. The temperature rise of G-E connectors is never greater than the temperature rise in the conductor. These features mean you'll get full power flow through your connectors.

Wide range of sizes means your stock problems will be cut to a minimum when you use these new G-E connectors. With A-1, A-2 and D connectors you can accommodate the same range of conductors—with fewer connector fittings. A complete line of connectors, such as straight, tee, block, angle, parallel, expansion, ground, and many others, is available. Why not place a trial order today with your G-E sales representative and see for yourself how these new connectors can cut down on your stock and maintenance problems? Write for bulletin GEC-400 that contains 44 pages of valuable information on these new connectors.

Apparatus Dept., Section 856, General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC

"100,700 kvar in connected Capacitors equals 53% of our system peak load"

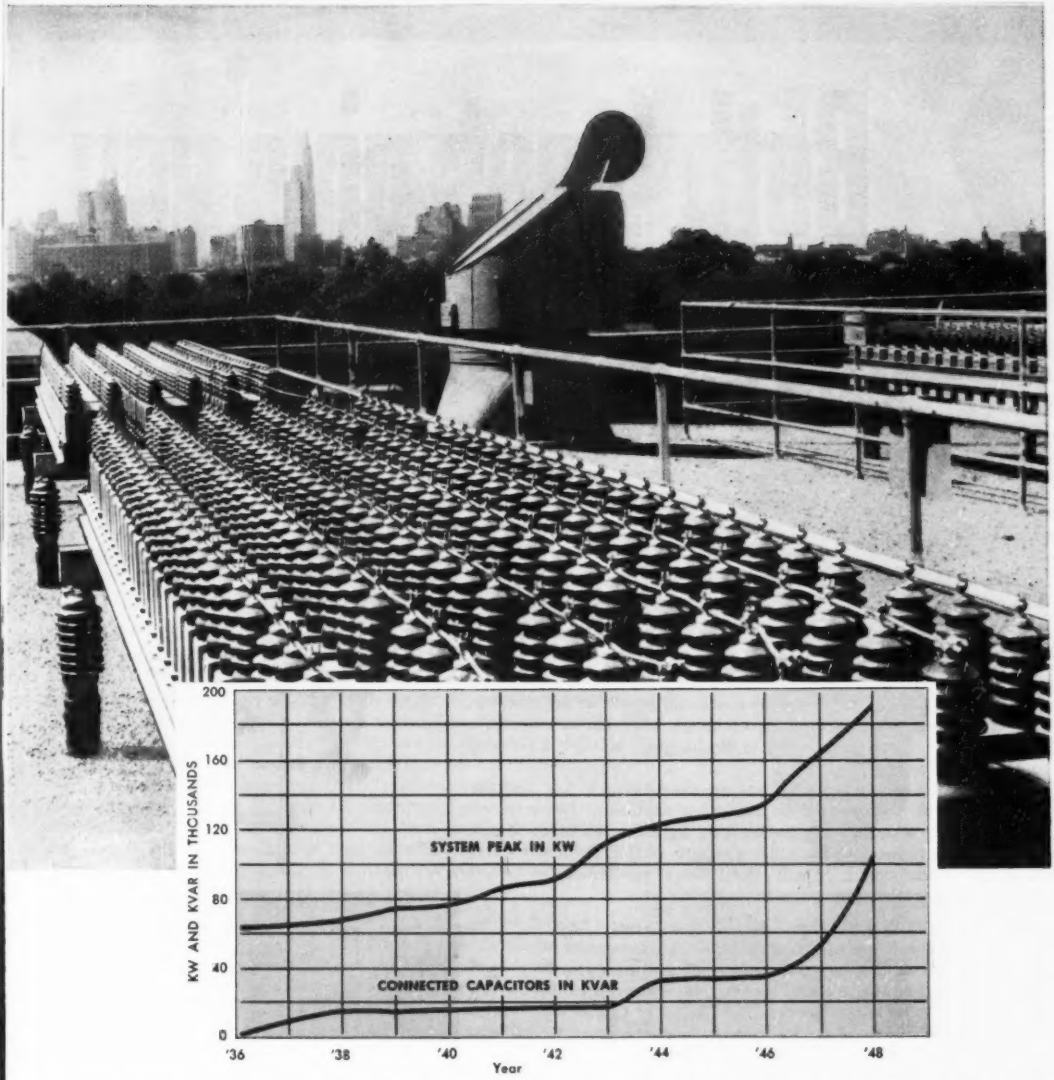
DALLAS POWER & LIGHT COMPANY

This is the story that Dallas Power & Light Company tells about capacitors:

"We have an unusual load problem in Dallas air conditioning. As an indication of its importance, our system peak load now occurs in the summer. It has been a major factor in the doubling of our peak load since 1942. And—introducing induction motors into office buildings, apartments, and even private residences—it has had a marked effect on the power factor of our system.

"As a result, kvar generation has become a major consideration with us. We doubled our kvar in installed capacitors in 1944, and we have tripled that figure in the last two years—until today, our 100,700 kvar in connected capacitors equals 53 per cent of our system peak load.

"Other central stations may find it of interest to note where and how we have used these capacitors: Approximately half of them (48,000 kvar, in round numbers) are installed as unswitched capacitors on our 4 kv and 13 kv overhead systems. A third (35,000 kvar) are installed as switched capacitors at our substations. About 16,000 kvar are installed on the



underground network, mostly as 230-volt capacitors, and 82 per cent of them switched. We have a little more than 1000 kvar, switched, connected to the 480-volt auxiliary bus of our steam-electric station. And finally, within the last few months, we have installed one hundred 3-kvar 240-volt capacitors on transformer secondaries in residential districts.

"Needless to say, capacitors are very important to us. We are submitting a chart which shows how our installations have increased—until now our kvar in capacitors exceeds our peak load of only six years ago."

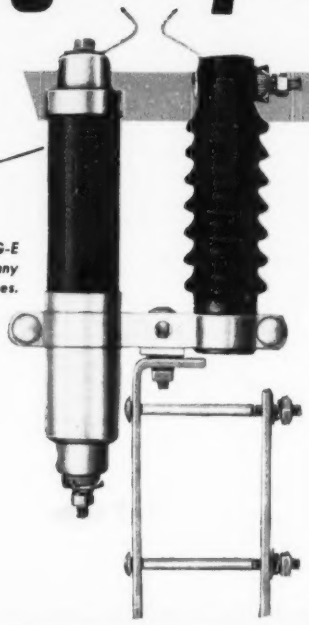
The purpose of these advertisements is to encourage electrical utilities to exchange information on the use of power-factor-improvement capacitors. We believe that such an exchange will best bring out that capacitors can be used much more widely than at present—that they provide the fastest way of increasing peak-load capacity—that they can bring many utilities extraordinary returns by increasing capacity of existing distribution lines, transmission lines, transformers and circuit breakers—and that they offer one of the best possibilities of scaling down system costs per kilowatt. If your experience with capacitors would be of interest and value to other companies, we would like to hear from you. Contact your G-E Representative or write *Apparatus Dept., General Electric Co., Schenectady 5, N. Y.*

GENERAL ELECTRIC

407-12

Both types give you

HI-STROKE ARRESTERS



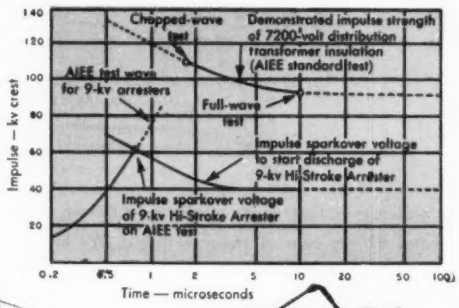
A recent G-E development with many exclusive features.

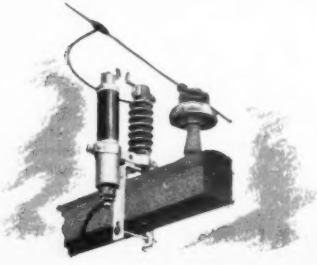
The Hi-Stroke is an *expulsion-type* arrester, designed especially for rural systems—6-kv rating for 4800-volt circuits, 9-kv rating for 7200 and 7200/12470-volt grd Y circuits.

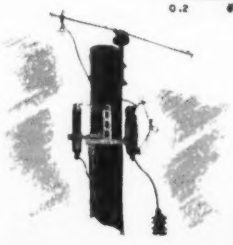
LOW SPARKOVER GIVES YOU EXTRA PROTECTION. With an expulsion type arrester, the protection afforded transformers and other equipment is measured by the "impulse sparkover level" of the arrester. This is the surge voltage, to start discharge, when the arrester goes into operation. Once the arrester is discharging, voltage is reduced to practically zero.

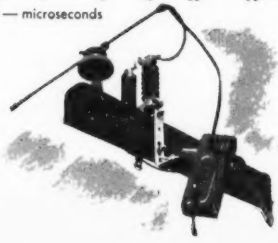
The G-E Hi-Stroke arrester has an exceptionally low impulse sparkover level, unsurpassed by any other expulsion-type arrester. It protects by a large margin—limiting lightning voltages to not over ½ the demonstrated impulse strength (AIEE standard tests) of modern transformers. It will afford liberal protection even to old transformers.

EXTRA LIFE—BUILT IN. Only the G-E Hi-Stroke arrester has a reserve supply of gas-evolving material to compensate for erosion during discharge. Celofiber spheres are automatically fed into the arc-interrupting chamber—an exclusive feature for longer service life. On badly exposed rural lines, the Hi-Stroke arrester has established a practically perfect record of protection and endurance to severe lightning-stroke currents. Ask for Bulletin GEA-4582.









extra protection!

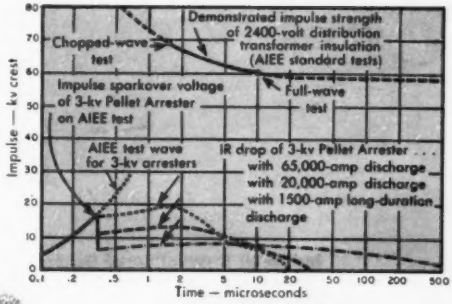
PELLET ARRESTERS

The quality-standard of the industry for more than 25 years.

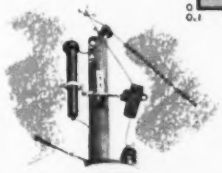
The Pellet is a *valve-type* arrester for universal use on urban, rural, or industrial systems — available in ratings of 1-kv to 15-kv, inclusive.

LOW SPARKOVER AND LOW IR DROP GIVE YOU EXTRA PROTECTION. With a valve-type arrester, the protection afforded transformers and other equipment is dependent on both sparkover voltage to start discharge *and* the IR drop across the arrester *during* discharge. The latter depends on the ability of the arrester valve-element to decrease its resistance with increase in discharge current.

With G-E pellet arresters, initial sparkover voltage is low—for a 3-kv pellet arrester, for example, less than $\frac{1}{3}$ of the AIEE impulse test level of 2400-volt transformers. And—the *exceptionally low* IR drop, at low, medium or high lightning currents—is a distinctive feature that gives *extra protection* compared to any other valve-type distribution arrester.



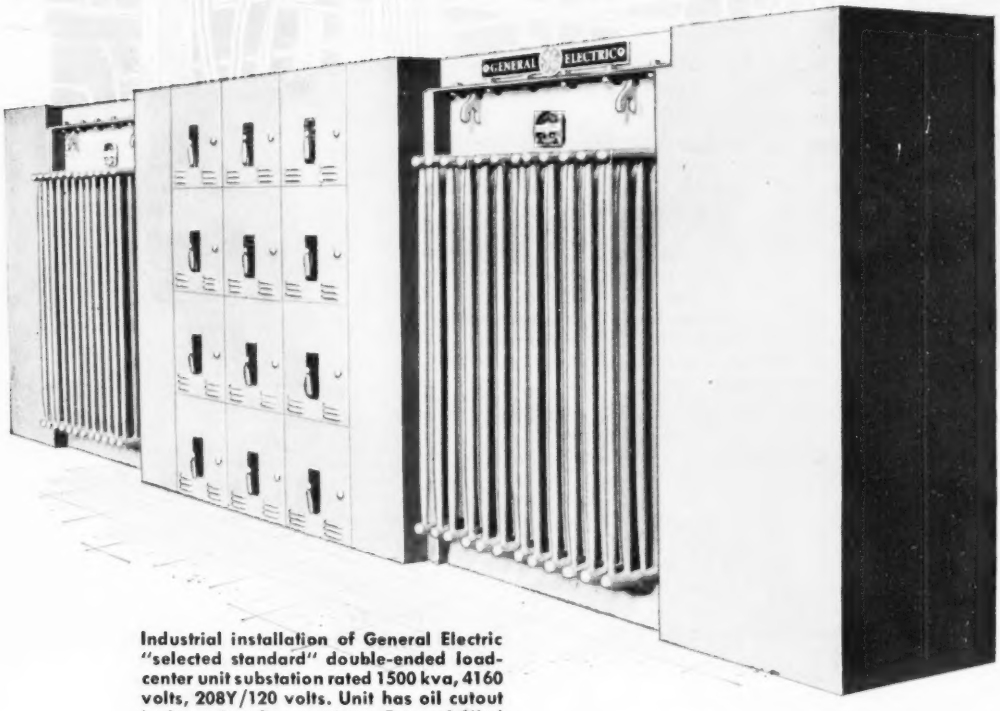
EXTRA DURABILITY — BUILT IN. G-E pellet arresters defy moisture. Pellets, themselves, are of lead peroxide—a distinctive valve material whose characteristics are unaffected by moisture. And, dry nitrogen (N_2) is sealed into the gap-chamber of all G-E pellet arresters—an exclusive G-E feature. This dry inert gas prevents formation of ozones or oxides—keeps the gap electrodes bright as new during years of service operation. Ask for Bulletin GEA-2975D, *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*



GENERAL ELECTRIC

405-30

new load center unit



Industrial installation of General Electric "selected standard" double-ended load-center unit substation rated 1500 kva, 4160 volts, 208Y/120 volts. Unit has oil cutout in incoming line sections, Pyranol-filled transformers, and the new AK-1 air circuit breakers.

* *Be sure to see the "More Power to America" full-color sound slidefilm "Modern Industrial Power Distribution." Ask your G-E sales representative to arrange a showing for your organization.*

substations

• improved appearance

Note the smooth, integrated appearance of these new G-E Pyranol® unit substations . . . no more gawky, "old-type" bus-duct connections between transformer and switchgear . . . now you can get the effortless flow of line and power that characterizes quality equipment for locations where appearance is a requisite.

• 'selected standards'

Based on surveyed demands of industry and proposed NEMA specifications, "selected standard" ratings have been inaugurated to bring you these efficient new load centers on shorter shipment. The most popular "selected standard" ratings are:

Low voltage—480△, 208Y/120 volts
High voltage—2.4, 4.16, 4.8, 12, 13.2, 13.8 kv
Kva ratings—300, 500, 750, 1000, 1500, 2000

Certain other "selected standard" load centers are available. Contact your G-E sales representative for further information.

• shorter shipments

By ordering "selected standards," you get really short shipments on Pyranol and dry-type load centers. Deliveries are in line with average plant construction schedules and it is suggested that load centers be ordered when construction begins.

• high impulse levels

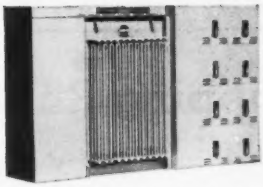
Pyranol unit substations with their inherently high impulse levels are particularly suitable for locations that are subject to switching surges and lightning.

Remember too, that G-E load-center power distribution is the most economical power distribution you can buy . . . no heavy, costly long-run feeders, no "piecemeal" purchases, no divided responsibility.

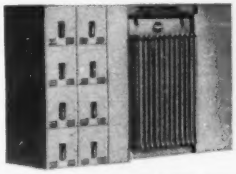
You'll save time too, because G-E "selected standard" load centers eliminate weeks spent over drawing boards detailing individual items; you'll save time because G-E factory-assembled unit substations are quickly and easily installed—in the center of the load area—with lower material and labor costs than required for "piecemeal" assemblies.

Ask your G-E sales representative *today* about how "selected standard" load centers can save time and money in your plant. Also, write for Bulletin GEA-3592.

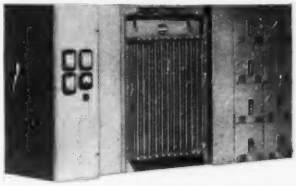
• *Apparatus Department, General Electric Company, Schenectady 5, New York.*



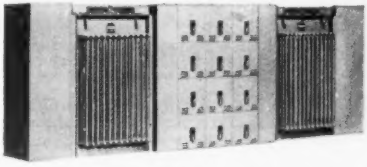
Typical 500 kva G-E "selected standard" load-center unit substation (standard arrangement). Unit consists of primary interrupter switch, liquid-filled transforming section, and low-voltage feeder switching section with the new Type AK-1 drawout breakers.



Same as unit shown above but with reversed arrangement.



Typical 500 kva G-E "selected standard" load-center unit substation with liquid-filled transforming section, metal-clad air power circuit breaker for incoming line-protection, and low-voltage feeder switching section with the new Type AK-1 drawout breakers.



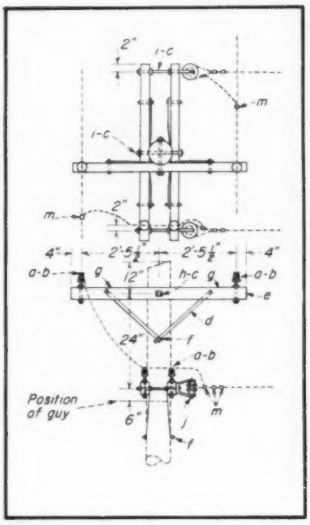
G-E "selected standard" double-ended load-center unit substation rated 1500 kva with primary interrupter switches, liquid-filled transforming sections, and low-voltage feeder switching section with G-E Type AK-1 drawout air circuit breakers arranged for secondary selective service.

GENERAL ELECTRIC

321-57

Tapping Rural 2400-v Lines

Methods used by Central Maine Power Co to make single-phase taps. For use with conductors of copper and 6A composite only



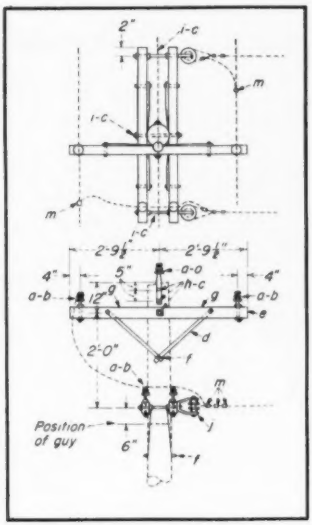
2400-v, 1-ph, Ungrounded

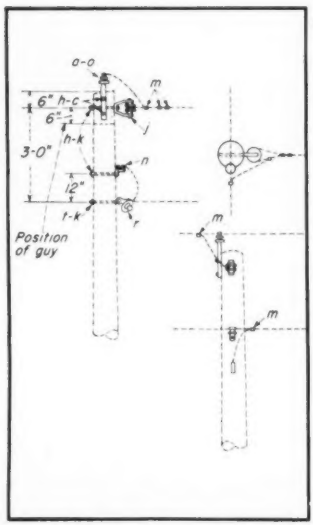
Item	Quan.	Material
a	4	Insulators, 5 kv
b	4	Steel pins
c	10	2¼-in. square washers
d	6	Crossarm braces
e	3	Crossarms
f	3	Toe bolts
g	6	Carriage bolts
h	1	Machine bolt
i	3	Space bolts
j	2	Insulated clevis
m	8	Connectors

2400-v, 3-ph, Ungrounded

(Tap may be any two of three wires)

Item	Quan.	Material
a	5	Insulators, 5 kv
b	4	Steel pins
c	12	2¼-in. square washers
d	6	Crossarm braces
e	3	Crossarms
f	3	Toe bolts
g	6	Carriage bolts
h	3	Machine bolts
i	3	Space bolts
j	2	Insulated clevis
m	8	Connectors
o	1	Pole tap fixture





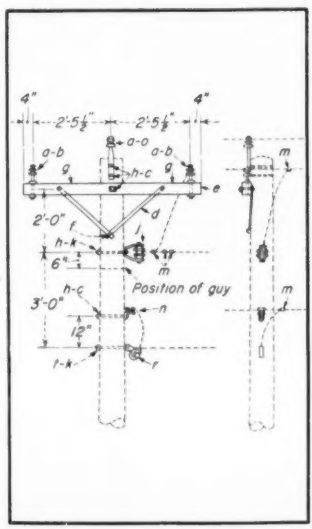
2400 4160 Y, Grounded Neutral

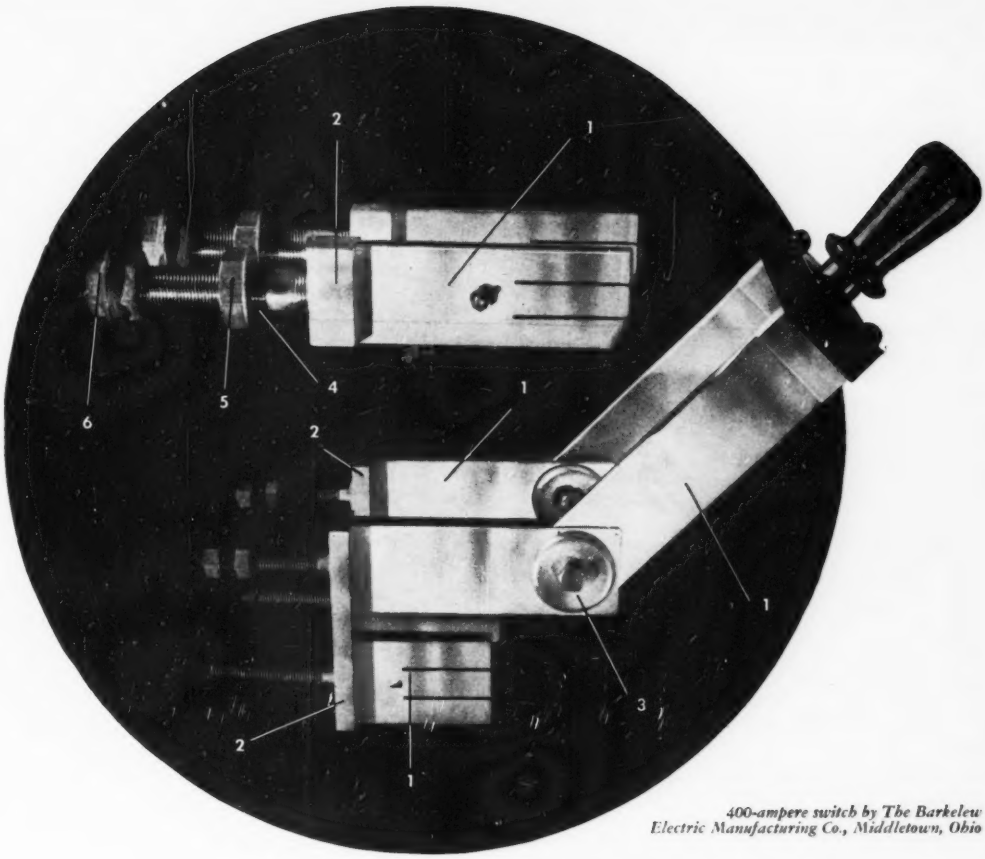
Item	Quan.	Material
a	1	Insulators, 5 kv
c	2	2¼-in. square washers
h	4	Machine bolts
j	1	Insulated clevis
k	3	3-in. curved washers
m	5	Connectors
n	1	Neutral bracket
o	1	Pole-top fixture
r	1	Dead-end clamp
t	1	Eye bolt

2400 4160 Y, 3-ph, Grounded Neutral

(Tap may be on any phase wire)

Item	Quan.	Material
a	3	Insulators, 5 kv
b	2	Steel pins
c	5	2¼-in. square washers
d	2	Crossarm braces
e	1	Crossarm
f	1	Toe bolt
g	2	Carriage bolts
h	5	Machine bolts
j	1	Insulated clevis
k	2	3-in. curved washers
m	5	Connectors
n	1	Neutral bracket
o	1	Pole-top fixture
r	1	Dead-end clamp
t	1	Eye bolt





400-ampere switch by The Barkelew Electric Manufacturing Co., Middletown, Ohio

WIDE VARIETY OF REVERE METALS PERMITS EXACT SPECIFICATION TO MEET CONDITIONS OF USE

Note the number of different Revere Metals used by Barkelew in this switch, in order to assure low losses, reliability, accuracy, long life and economical manufacture.

1. *Electrolytic Copper.* For full conductivity.
2. *Free-Cutting Copper.* For quick, economical, trouble-free machining; in this case, producing sharp, clean, accurate slots and tapped holes in the copper base blocks. Free-cutting copper is rated in excess of 70% machinability of free-cutting brass, depending on type of operation.
3. *Herculoy.* Has the strength of mild steel, the corrosion-resistance of copper. The Herculoy washers in this switch assure permanence of pressure.
4. *Brass.* Washers, stamped out of sheet.
5. *Free-Cutting Brass.* Nuts, machined from free-cutting rod.
6. *Cast Electrolytic Copper.* For nuts not presenting machining problems.

Materials were very carefully chosen in designing this switch. For example, the hinge block for the high clip must have two slots milled in it to receive the clip leaves; Revere Free-Cutting Copper was selected for its superior machining characteristics. Slots in the lower hinge blocks are sawed all the way through, and here Revere Hard Drawn Electrolytic Copper is suitable.

Revere will gladly cooperate with you in working out the most advantageous application of metals to your products. Revere Metals are: Copper and Copper Alloys, Aluminum Alloys, Electric Welded Steel Tube.

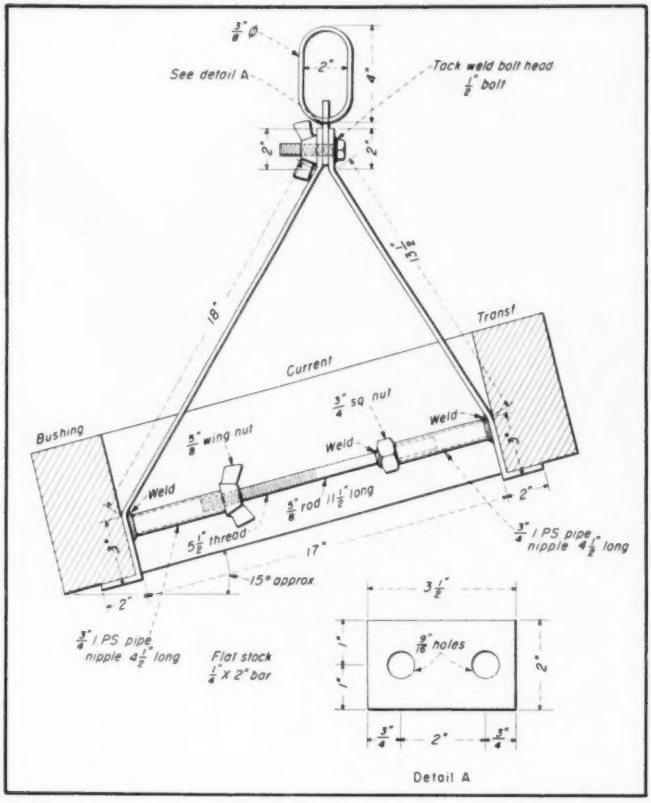
REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich., New Bedford, Mass.; Rome, N. Y.—Sales Offices in Principal Cities, Distributors Everywhere.



LIFTING DEVICE for removing 132-kv bushing current transformers from breaker housing

Improved Lifter for 132-Kv Bushing Current Transformers

ALFRED WESSEL
Substation Foreman
The Ohio Power Co
Lima, Ohio

WHILE MODERNIZING the 132-kv oil circuit breakers at the Rockhill Substation, it was necessary to remove the six bushing current transformers from each breaker and transport the transformers to the repair shop. We had a lifting device which had been used previously but it was not satisfactory on this job.

The illustrated lifter was made and we were able, thereby, to reduce the time required to remove the transformers. This device has two distinct advantages over the previous one—it is easier to install; it lifts a current transformer out of its housing at the angle at which it normally rests.

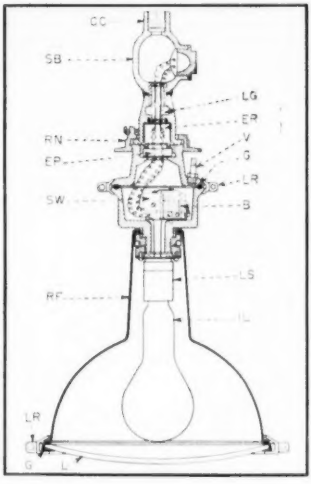
The improved device has unequal-length sling members of ¼x2-in. flat steel. The members are assembled at the top to a flat plate with a ring and at the bottom to an expansion member of ¾-in. pipe and ⅝-in. diam. threaded rod as shown. The old lifter had eight bolts which had to be loosened and tightened each time a current transformer was to be lifted. The new device has only two wing nuts which make possible a considerable saving of time when installing it for a lift and removing it after the transformer is in place. Since the illustration was made, U-bolts have been added to the sides of the lifter for attaching guide ropes.

Air-Pressure Compartment Featured in Lighting Unit

W. F. WHOLEY
President
Safe Lighting, Inc,
Jackson Heights, L. I., N. Y.

AN INDUSTRIAL lighting fixture has been developed for operation with a higher-than-ambient air pressure in the lamp compartment. The higher pressure is used to prevent the entrance of surrounding hazardous atmosphere to the immediate vicinity of the lamp and its contacts. This characteristic was one consideration in the fixture being approved for Class 1 Group A and Group B hazardous locations. The air pressure is used also to control the lamp circuit.

Air is introduced through a valve to the lamp compartment to about 10-psi gage. This air sealed inside the housing fixture puts pressure on a bellows which holds closed two switches for the lamp circuit. If for any reason the inside air pressure should fall to 3½ psi or lower, the sections are held together by a threaded ring nut. This construction

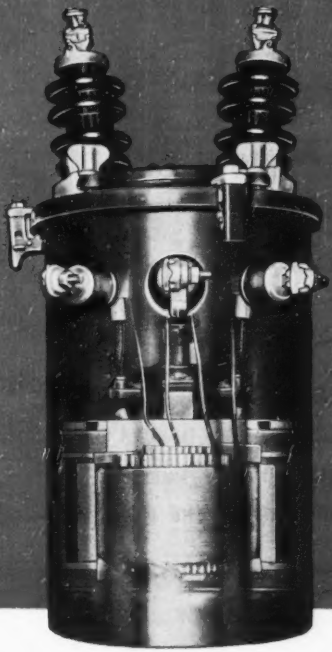


LIGHTING FIXTURE of explosion-proof type has a lamp compartment with sealed-in air pressure. B—bellows; CC—conduit connections; EP—plug; ER—receptacle; G—gasket; IL—incandescent lamp; L—lens; LG—lith-arge mix; LR—lock ring; LS—lamp socket; RF—reflector RN—ring nut; SB—splice box; SW—switch; V—valve

MOLONEY HiperCore DISTRIBUTION TRANSFORMERS

15 TO 30% LIGHTER

SMALLER SIZE



GREATER SHORT-TIME OVERLOAD CAPACITY

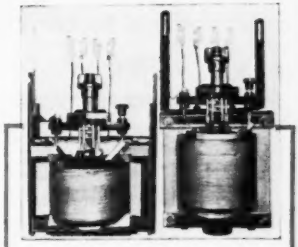
BETTER VOLTAGE REGULATION

Moloney HiperCore Transformers have cores of cold-rolled, high permeability, oriented silicon steel. The improved characteristics of this core material make possible reductions in transformer size and weight, better voltage regulation and increased short-time overload capacity.

Reductions in size and weight range from 15% to 30%. Because they are smaller and lighter, HiperCore Transformers are more easily and quickly installed on the poles . . . are easier to handle and take up less space on the line truck and in the storeroom.

Through lower impedance, better voltage regulation is possible at all loads with HiperCore Transformers. This means greater customer satisfaction . . . because of reduced secondary voltage fluctuations during sudden or intermittent load changes . . . and because of decreased voltage drop during peak load periods.

HiperCore Transformers have improved short-time overload characteristics which provide better peak load performance and longer life. Reduced coil mass, together with extensive use of cooling ducts, results in more rapid cooling of the windings and in a lower hottest-spot temperature gradient.



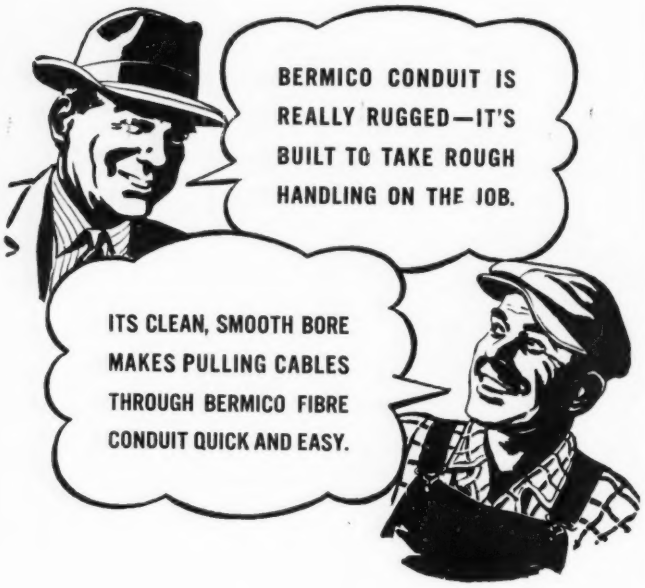
HiperCore core-and-coil unit and conventional type core-and-coil unit. Both are rated 3 Kva, 12470 Gr. Y/7200-120/240 volts. Smaller size of HiperCore unit achieved by use of wound cores made of high permeability, oriented, silicon steel.

MOLONEY ELECTRIC COMPANY

Sales offices in all principal cities

FACTORIES AT ST. LOUIS 20, MO., AND TORONTO, ONTARIO, CANADA

BERMICO* FIBRE CONDUIT


BERMICO CONDUIT IS REALLY RUGGED—IT'S BUILT TO TAKE ROUGH HANDLING ON THE JOB.
ITS CLEAN, SMOOTH BORE MAKES PULLING CABLES THROUGH BERMICO FIBRE CONDUIT QUICK AND EASY.

distributed by
WESTINGHOUSE ELECTRIC SUPPLY COMPANY
Offices in all leading cities

BERMICO FIBRE CONDUIT—A PRODUCT OF BROWN COMPANY

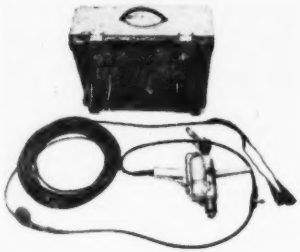
provides for removal of the lamp compartment to a non-hazardous area for relamping and "recharging" to about 10 psi. The gasketed lens is removed for replacement.

Incandescent lamps in sizes 75 to 200-w can be used. The inside of the aluminum lamp compartment housing serves as a reflector.

Maximum equilibrium temperatures for a 200-w fixture with an ambient 27 C, shielded from radiation, range from 121 C at center of lens to 74 C at reflector top.

Portable Kit Used For Line Construction

R. E. DUNCAN
Distribution Department
and
F. M. ZIMMER
Distribution Superintendent
The Ohio Power Co
Canton, Ohio



PORTABLE DRILL KIT consists of power drill with ½-in. chuck and 60-ft cord to which is attached chuck key (right) and shielded series socket with 15-amp fuse (left). Eight bits are mounted inside the case cover

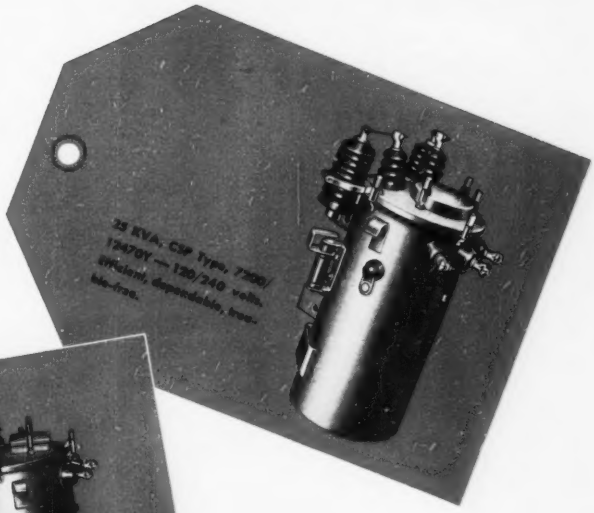
A PORTABLE electric drilling kit has been arranged for line construction and repair work involving repetitive tasks on wood structures where 120-v service is readily available. Standard equipment is used except for the modified drill switch and drill shanks. Use of the kit has been warranted by the economics outlined in ELECTRICAL WORLD, March 12, 1949, page 148.

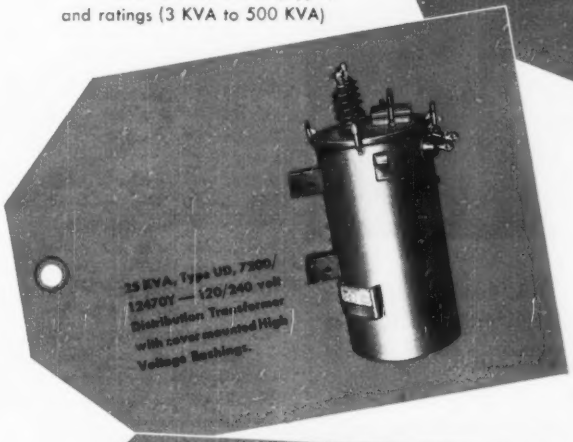
The drill is a standard 120-v Thor V-44 model with a ½-in. chuck. It was selected because its speed is not excessive for the work intended and its weight is not excessive for use by a lineman on a pole.

The drill has a trigger-type switch from which the locking mechanism has been removed. Hence, if the bit

Uptegraff Distribution Transformers

All commercial sizes, types and ratings (3 KVA to 500 KVA)





25 KVA, Type UD, Distribution Transformer rated 2400/4160Y—120/240 volts with pocket mounted H. V. Bushings. Shown with hanger irons.

The high efficiency and dependability of Uptegraff Distribution Transformers are the result of extensive experience in the design, construction and application of all types and sizes of transformers. The three types shown here represent the best of modern engineering practice. Some of the features are: light-weight cores with preferred grain orientation for low exciting current, extra short-time overload capacity, heavy-duty construction, provision for NEMA standardized accessories, oil or askarel immersed.

WRITE
for complete details.

R. E. UPTEGRAFF MANUFACTURING CO.
Scottdale, Pa.

Makers of POWER • DISTRIBUTION • INSTRUMENT • SPECIALTY Transformers

A chain is only as strong as its weakest link. Prevent weak links in your product by using ILLINOIS bushings produced to meet your engineers' most exacting specifications.

ILLINOIS' thorough control of production methods results in the manufacture of porcelain bushings of high dielectric and great mechanical strength, with the utmost in dimensional accuracy. Careful kiln drying and firing, at constant temperatures, prevent internal stress.

These bushings can be standard glaze or radio interference-proof glaze. Dry type bushings are produced for all voltages up to 34.5 kv. Gasket seats are smooth and ground when required.

★

Complete Uniformity
Exact Dimensions
High Dielectric Strength
High Mechanical Strength

★

Specify Illinois Porcelain
for Dependability and Economy

ILLINOIS
ELECTRIC PORCELAIN CO.
MACOMB • ILLINOIS

should seize the wood or strike a nail or other obstruction, and be forced from the operator's grasp, the drill will stop immediately. An additional safety precaution has been taken, namely, to instruct all men never to bore a hole when a man is on the opposite side of the pole or material being drilled.

Standard ship augers and car bits are used, but the square shank has been cut off to fit the drill chuck. The bit holders inside the case cover are made from short lengths of split garden hose. The drill is equipped with a snap hook for convenient attachment to the lineman's belt. It is connected to a 60-ft rough-duty rubber-covered duplex-wire cord with clip terminals having rubber shields. Also connected to the drill cord is a shielded series socket for a 15-amp fuse, and the chuck key (to avoid its loss).

The carrying case is constructed of ½-in. wood. The over-all dimensions are: 19½ in. long, 13½ in. wide, 10 in. deep. Two holes are bored in the narrow top side for a rope handle. The cover, which carries the drills, is attached to the case by two hinges and kept closed by two hasps.

Each truck in the Canton Division is equipped with a carrying case for the drill kit and an extra 60-ft length of rubber-insulated cord for use where the available power supply requires it.

Stringing Sled Saves Time and Effort

F. E. HORNBECK
Results Engineer,
Cabin Creek Plant
Appalachian Electric Power Co
Cabin Creek, West Virginia

A SPECIALLY DESIGNED running board or stringing sled reduces physical effort required of linemen during stringing operations. Designed by California Electric, this device strings three conductors up to No. 4/0. In combination with trailer-mounted reels controlled by mechanical breaking, it has cut stringing time by about 50%.

The sled is made of heavy gage sheet metal and a single pulling bar by California Electric Power Co. The metal is shaped with a blunt-pointed end which curves up to give a sledding effect in operation. When the

YOU'RE right, Mr. Motorist! You can easily read the fine print with the new Joslyn Permalux Suburban Luminaire. Because this reflector directs a brilliant light right where it is wanted—along the street and sidewalks.

The Permalux Reflector is made of stainless steel with hard highly polished specular surface for high, permanent reflectivity . . . there is no thin film to errode or wear away!

The attractive appearance and modern design of the Joslyn Permalux Reflector combines high efficiency with low cost. The variable cutoff angle from 45 degrees on the house side to 83 degrees up and down the street assures maximum utilization with minimum glare.

Joslyn reflector attachments are available to fit most porcelain and metal heads.

It says here, but NOT in fine print, you'll be wise to modernize your old fashioned inefficient luminaires with the Joslyn Permalux reflectors.

- Controlled reflection puts light where it is needed
- High reflector efficiency provides more useful light per watt
- Irritating glare is eliminated
- Rugged durable construction
- Economical initial cost plus long life

Branch offices in principal cities

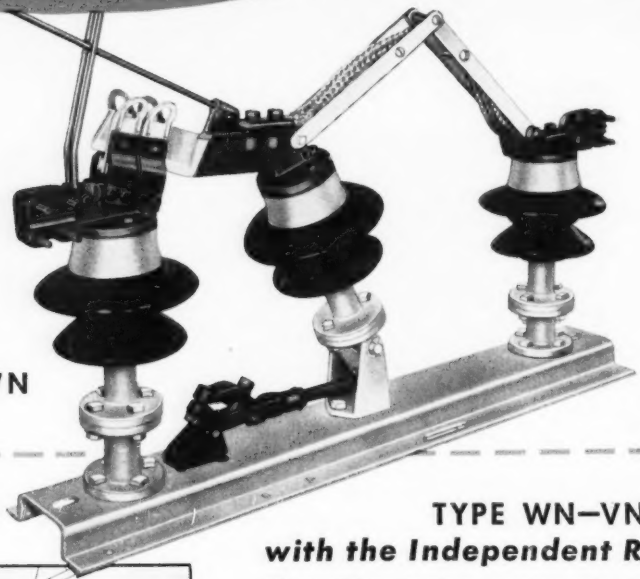
THE JOSLYN CO
THE SOUTH EAST JOSLYN CO
SOUTHERN JOSLYN CO
JOSLYN SOUTHWEST CO
JOSLYN PACIFIC CO

JOSLYN MFG. AND SUPPLY CO.

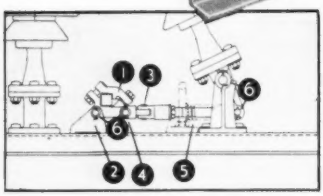
Complete Pole Line Equipment

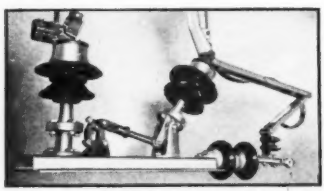
20 NORTH WACKER DRIVE, CHICAGO 6, ILL.

CHANCE Power



TYPE WN





TYPE VN

TYPE WN—VN
with the Independent Rockershaft

Chance Tilting Insulator Switches make positive contact on all phases because the Rockershaft operates independently of the tilting insulator. Not affected by angular distortion . . . each blade in a three-pole switch makes a complete contact without affecting the other two blades.

- **EASILY INSTALLED AND ALIGNED . . .** Removable clamps (1) permit shaft to be laid in position after switch units are mounted. Rockershaft base (2) pivots to aid alignment with operating shaft. Pivot base and universal joint (3) compensate for warpage of supporting structure.
- **POSITIVELY NO SLAMMING . . .** Special toggle joint (4) prevents slamming of blade when closing.
- **EXTRA LEVERAGE** of Rockershaft gives smooth, easy operation with ample power to break ice accumulation. Bumper spring (5) cushions operating movement and helps start closing motion.
- **NO OILING . . .** All working joints are fitted with Oilite bearings (6) for smooth, lifetime operation.
- **UNIVERSAL TERMINALS . . .** Reversible switch terminal blocks accommodate cable ranging from No. 4 solid copper to 600,000 C. M. or ½" and ¾" I. P. S. tubing.

C491

ABC INDUSTRIES

A. B. CHANCE COMPANY
CENTRALIA, MO.
SAN FRANCISCO, CALIF.

You know it's

Switching Equipment

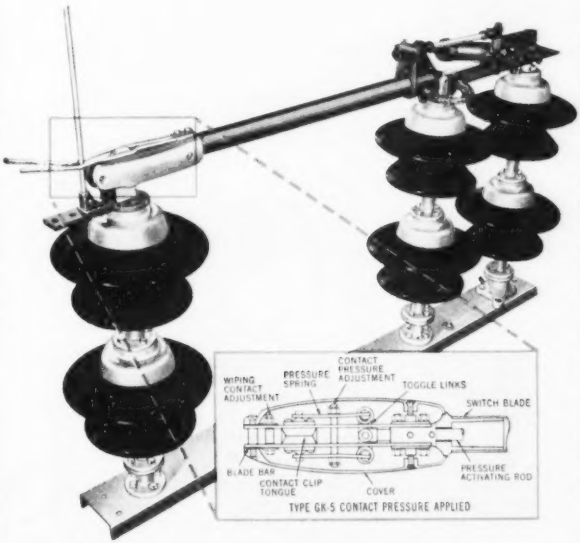
TYPE XX—Center Break
7.5 through 230 Kv.

Designed primarily for use on installations where phase spacing or operating room is limited.

EASILY OPERATED . . . Insulator stacks, driven by crank and link mechanism, rotate in opposite directions to open the switch with a shearing action that easily breaks ice accumulations.

SILVER-INLAID, PROTECTED CONTACTS . . . Non-ferrous housing provides corona shielding and sleet protection for contacts. Heavily silver-plated blade produces low resistance contact. Contact springs, out of current path, maintain positive pressure.

Type XX Switches are made in standard voltage ranges from 7.5 through 230 Kv., 400 through 1200 Amps.



TYPE GK-5 CONTACT PRESSURE APPLIED

TYPE GK-5
For Sub-Station and Line Disconnect Service up to 287 Kv.

LARGE AREA CONTACTS provide maximum thermal capacity.

SILVER CONTACT SURFACES maintain lower contact resistance by preventing copper oxidation.

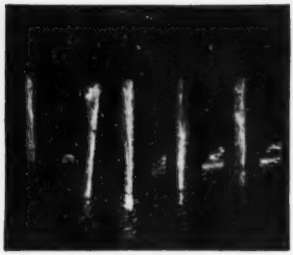
CONTACTS WIPE CLEAN WITHOUT ABRASION . . . Blade and clip contacts engage with gentle wiping action that cleans surfaces without abrasion.

HIGH CONTACT PRESSURE APPLIED AFTER CLOSING . . . High pressure is attained between blade and clip by the final movement of operating mechanism. This pressure is attained without abrasive movement between blade and clip contact surfaces. Contact pressure is released *before* blade moves in opening operation.

Diagram shows Type GK-5 contact mechanism. After closing motion is completed, cam-actuated control rod causes toggle links to expand against the leaf springs and transmit high pressure to the contact surfaces.

RIGHT when you specify

KOPPERS CREOSOTE
-to be sure!



PILES 30 YEARS Pressure-*Creosoted* Piles give unrivalled protection against decay and marine borers. Many *creosoted* marine piling installations are reported sound and serviceable after more than 30 years of use. Pressure *creosoting* lowers maintenance costs.

DECKING 14 YEARS This car, with pressure-*creosoted* decking, was sidetracked for its first major repairs after 14 uninterrupted years of service. Usual life of untreated car decking is about 5 years. Not only did pressure-*creosoting* cut maintenance costs; it prolonged the revenue-producing life of the car.

BRIDGES 40 YEARS This is one of several pressure-*creosoted* timber bridges which is still in use after more than 40 years. The resistance of pressure-*creosoted* bridges to decay, year in and year out, assures uninterrupted service and low annual replacement costs.

POLES 30 YEARS On the average, Pressure-*Creosoted* Poles have a life expectancy of 30 years. Pressure-*creosoting* offers *proved* performance and dependability.

TIES 25 YEARS Pressure-*creosoting* pays off to railroads. The long life of pressure-*creosoted* ties (25 years isn't unusual) has cut replacement costs $88,500.00 annually.

All Standard Specifications
For All Types of Wood Preservation
KOPPERS CREOSOTE
KOPPERS COMPANY, INC. • Pittsburgh 19, Pa.

FIG 1—RUNNING BOARD as used by California Electric Power Co to string three conductors up to 4/0. Turned-up nose lifts conductors over crossarm, positions them in pulleys, reducing physical strain on lineman

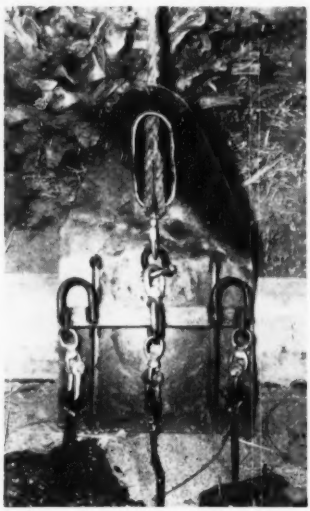


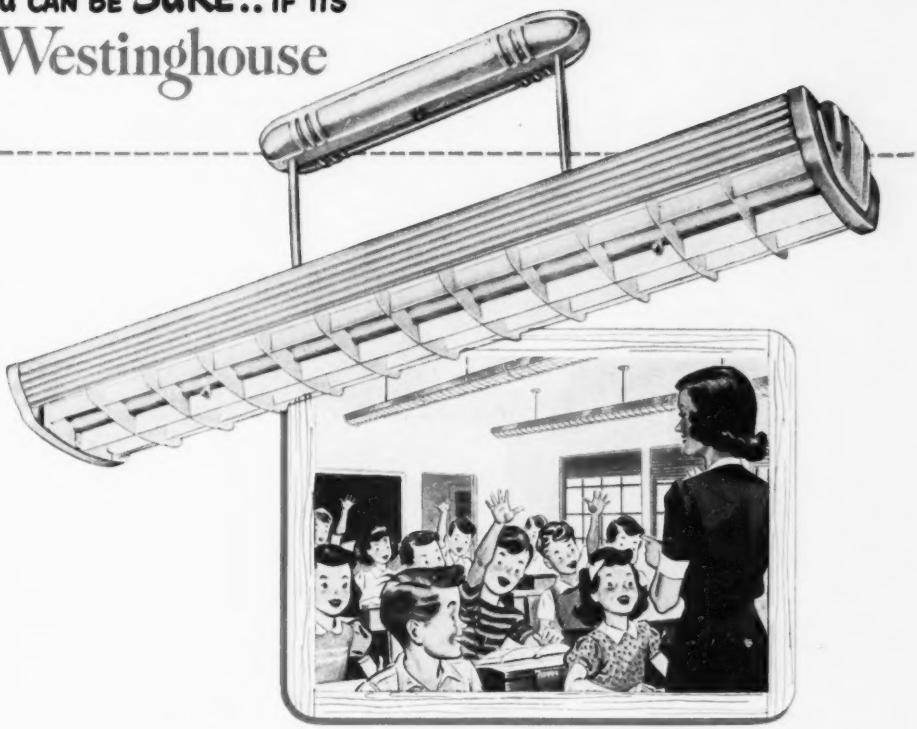
FIG 2—BLUNT-NOSED SLED is made of heavy gage sheet metal welded to a single bar which takes the pulling tension. Pulling line passes through oblong hole in upturned front end to give sledding effect

sled approaches a crossarm the lineman simply guides it to the pulleys. The sledding action saves him the exertion required to lift the conductors up and over crossarms.

Pulling line and three conductors being strung are attached to the bar by swivel eyes with standard clevises. To keep the board level with the line of pull the pulling line passes through a hole in the nose, as shown.

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



Give them good light—good sight

WITH "CD SERIES" LUMINAIRES

Be sure of good illumination as well as lasting performance when you buy Westinghouse Lighting Equipment. The CD Series Luminaires, designed for schools, combine the same engineering skill and manufacturing experience used in all other Westinghouse products.

When you buy luminaires for your school, ask for Westinghouse quality. It will mean good light—good sight for your students and operating economy for you.

A Westinghouse Lighting Engineer will gladly help you with your lighting problems . . . and he stands ready to co-operate with your local Power Company and Electrical Contractor in planning your schoolroom lighting. Call him at your local Westinghouse Distributor, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-04233

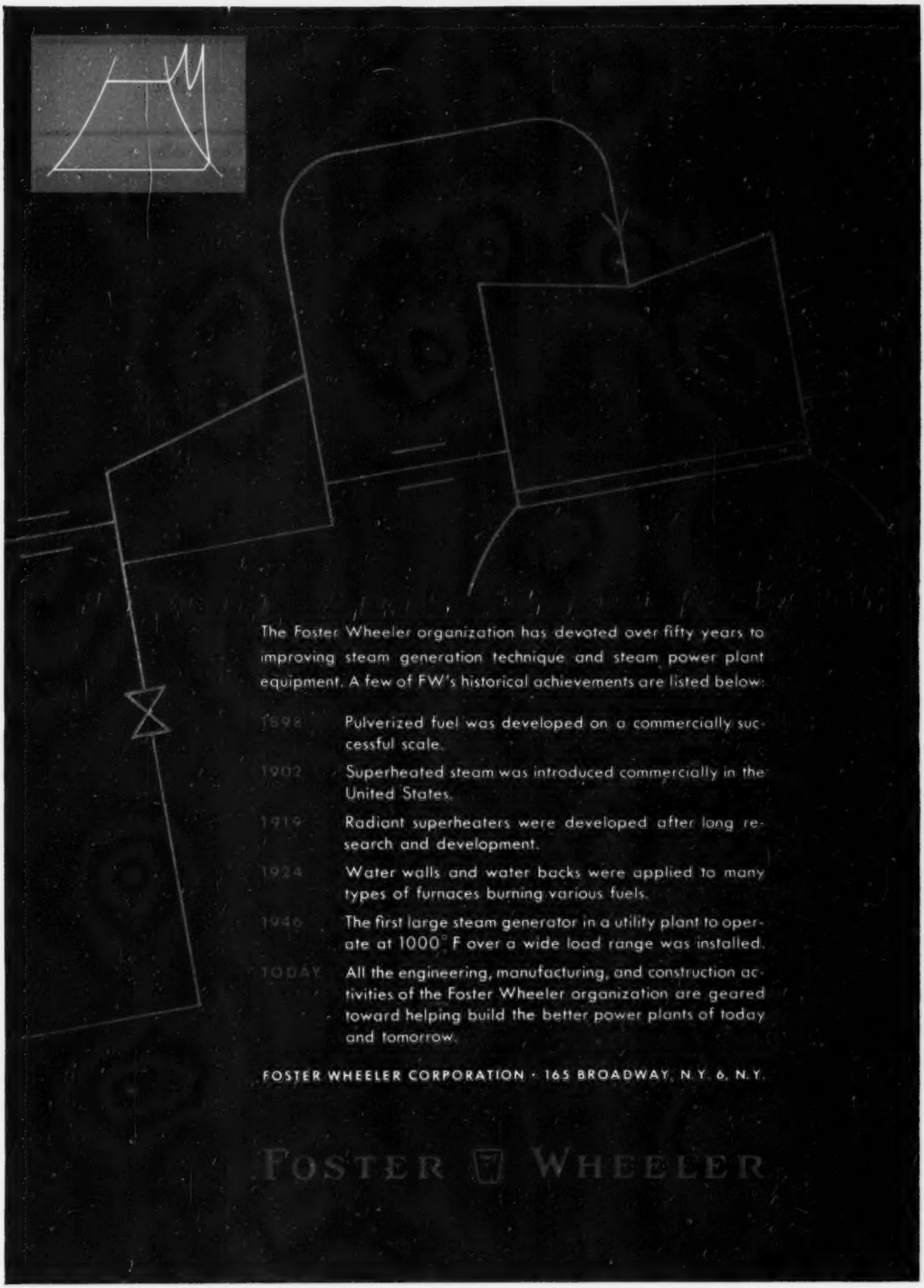
Westinghouse

PLANNED LIGHTING PAYS

steam generation – *an art*

RADIANT SUPERHEATERS AND RADIANT REHEATERS

. . . engineered and fabricated by Foster Wheeler, helped one midwest station earn the reputation for being the country's most efficient steam power plant.



The Foster Wheeler organization has devoted over fifty years to improving steam generation technique and steam power plant equipment. A few of FW's historical achievements are listed below:

1898 Pulverized fuel was developed on a commercially successful scale.

1902 Superheated steam was introduced commercially in the United States.

1919 Radiant superheaters were developed after long research and development.

1924 Water walls and water backs were applied to many types of furnaces burning various fuels.

1946 The first large steam generator in a utility plant to operate at 1000° F over a wide load range was installed.

TODAY All the engineering, manufacturing, and construction activities of the Foster Wheeler organization are geared toward helping build the better power plants of today and tomorrow.

FOSTER WHEELER CORPORATION · 165 BROADWAY, N.Y. 6, N.Y.

FOSTER WHEELER

LOAD BUILDING

FIVE ELECTRIC MELTING FURNACES installed at the Stockham Valve & Fittings, Inc., Birmingham, Ala., have replaced 14 gas-fired crucible furnaces formerly used for melting brass and bronze. Each furnace has a capacity of 500-lb of cold metal and is served by a 225-kva single-phase transformer tied to a 13.2-kv system. The units have lowered the cost per ton of metal melted

Electric Furnaces Produce Better Alloys

HIGHER QUALITY VALVES and fittings are now being produced by Stockham Valves & Fittings, Inc. Birmingham, Ala., as a result of the use of electric furnaces in place of gas-fired crucibles. The better quality products come from better control of alloys called for in the metallurgical specifications.

Five electric furnaces, each with 500-lb cold metal charge capacity, have been installed to replace 14 gas-fired crucible furnaces which produced brass and bronze used in the manufacture of pressure castings of valves and pipe fittings. The average melting down period is approximately 25 min from the time the charge of cold metal is placed in the furnace until it is ready to pour into a casting mold. Each furnace is served by a 225-kva single-phase transformer which is connected to a 13.2-kv distribution system.

L. N. Shannon, vice-president, says that advantages of the electric furnaces over gas or other fuel fired furnaces include a more rapid metal melting capacity for a given space; better working conditions for operators in that practically no heat escapes from the furnace; and an improvement in the melted metal itself, being more homogenous. This last is brought about by rocking the furnace during the melting period.

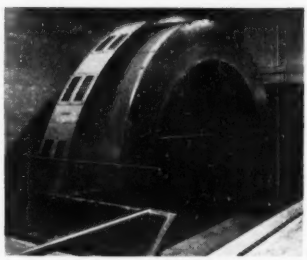
The company also reports that advantages of the electric furnace over gas fired crucibles have resulted in lower melting loss, lower refractory cost, and less maintenance—an overall saving in cost per ton of melt.

Installation was made in cooperation with Birmingham Electric Co power engineers.

Steel Output Increased By Use of 4000-Hp Motor

HOT STRIP production is increased 25% by a motor-driven intermediate continuous rougher recently installed at Tennessee Coal, Iron and Railroad Co, Birmingham, Ala. Driven by a special synchronous motor, the roughing stand reduces the 1½-in. bar from first roughing mill 0.5 to 0.6 in. in one pass. Because of this continuous flow, steel always is ready for entry into the next rolling step, thus speeding production.

The 4,000-hp, 78.3-rpm, 6,600-v,



SPECIAL 4,000-hp synchronous motor drives intermediate roughing stand

when specifying capacitors

which test

do you go by...

a ten hour lab record?

or a

ten year service

record?

cornell-dubilier capacitors

for power-factor improvement

15 kva., 7,960 v., Single Phase, 60 Cycle, Pole-Type Capacitor

Dependability is a word of exact meaning to engineers. That's why a 10 year record of power plant service with Cornell-Dubilier Capacitors means more to you than a short range lab test for questionable units. C-D's record of achievement speaks for itself: *with over 3,500 C-D power-factor installations in the field, few have needed even minor repairs when operated as long as 10 years.* Here's real dependability — in the full, exact meaning of the word. Contact your C-D field man for experienced power-factor improvement counsel. Cornell-Dubilier Electric Corporation, **Dept. D39,** South Plainfield, New Jersey. Other plants in New Bedford, Worcester, Brookline, Massachusetts; and Providence, Rhode Island.

CORNELL-DUBILIER · WORLD'[illegible]ANUFACTURER OF CAPACITORS

Follow the leaders.
Demand dependable C-D Capacitors for your system.

60-cycle, 80% leading power factor synchronous motor is directly connected to the mill. It has 350% maximum pull out torque, is 25 ft in diameter, carries its fly wheel on the spider spokes and is forced ventilated. Extremely accurate inching is obtained by introducing direct current into the stator while the rotor field is excited. The motor develops about 75% full load torque for inching.

Duquesne Light Drives on Water Heaters

ELECTRIC WATER HEATER SALES BONUS

1. Beginning February 1st and ending March 31st, the Duquesne Light Company will pay $10.00 cash bonus for each domestic electric water heater sale.

2. The water heater must be a domestic electric water heater of an approved type and size.

3. The water heater must be installed on Duquesne Light Company lines.

4. Dealers must fill in forms supplied for this purpose upon completion of sale and sent to our offices by not later than April 4, 1949.

5. Payment of bonus will be made upon completion of the installation of each water heater.

CURRENTLY, February 1 to March 31, the Duquesne Light Co is going all out on electric water heater promotion. Principal dealer stimulus is a $10 bonus for each heater sale, payable on installation. Additionally, the company allows 10¢ per line for dealer advertisements in Pittsburgh dailies and 25% of dealer cost for advertising in other newspapers.

The company is running 108 advertisements in papers in its service territory, taking 200 radio spot announcements, using 800 car cards, and putting sales material on electric bills. Counter and window display cards and hand-out pieces are available to dealers, as is a one-day training course for dealers' salesmen.

ELECTRICAL WORLD'S
75TH ANNIVERSARY EDITION
is coming May 21

Some Outstanding Lighting Achievements of 1948

Samuel G. Hibben, Director of Applied Lighting,
Lamp Division, Westinghouse Electric Corp, Bloomfield, N. J.

1. The former 100-w fluorescent lamp, through use of krypton gas and other improvements, has been reduced to 85 w with a gain of some 15% in efficiency.

2. An increase of ½ in. in the diameter of the 96-in. slimline fluorescent lamp makes possible burning at almost double the watts and lumens per ft, or up to 0.6 amp (at about 175 v operating).

3. The 25-w 33-in. T-12 fluorescent lamp, of 56 lumens per watt, capable of starting (through a ballast) on regular 115-v range lighting circuits, has been added to the line of now approximately 20 different sizes.

4. A 1-w, 10,000-hr, S-11 bulb fluorescent glow lamp, with bi-prong base fitting into any standard convenience outlet, affords a night light of small size to mark danger spots or to be used as a signal.

5. New colors of fluorescent lamps have been added—a better soft white to compliment complexions and a full line of fluorescent units in a color matching that of the average incandescent filament lamp.

6. A practical method was developed to add red to the color of light from high intensity mercury lamps with virtually no change in luminous efficiency. This improvement, though still experimental, will make this line of illuminants more usable, especially for industrial lighting.

7. Extraordinarily powerful flash tubes, using xenon or a similar rare atmospheric gas, now make possible photography of large indoor sets, or contribute to repetitive signals. One such tube was rated at 750,000,000 peak lumens.

8. Germicidal lamps closely approached an annual usage of 500,000 and reached a much improved sustained ultraviolet output through the use of Vycor glass. The year may be considered as one during which the general acceptance of bactericidal radiation was firmly established.

9. A new high-efficiency fluorescent sunlamp was announced in 20 and 40-w sizes.

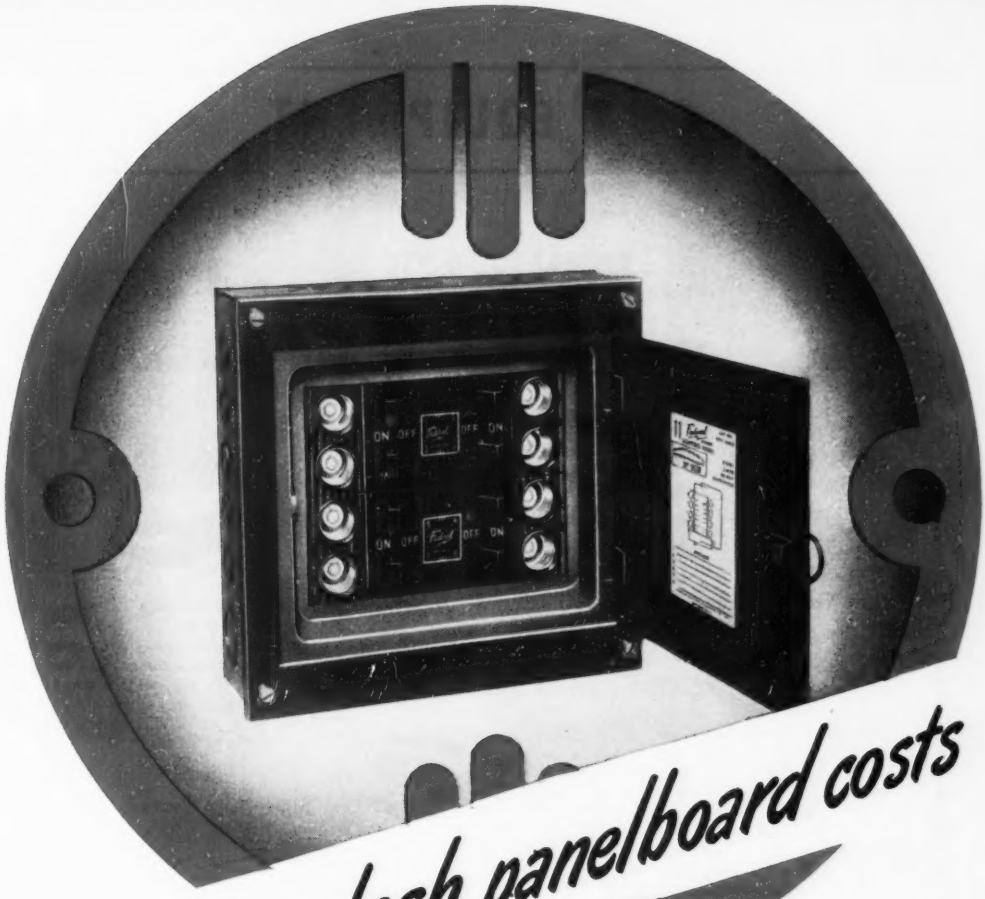
10. New standards for the lighting of outdoor stadia and sports areas were set through the use of some 1400 units of 1,500 w each (rated), but which totaled some 2,400 kw and produced grass-growing intensity of over 200 ft-c on a baseball infield.

11. Reflector bulb lamps increased in variety and usage. The 75-w, R-30 and PAR-38 bulb sizes supplemented such other new ones as the 500-w size, and were joined by automotive type sealed reflector bulbs, PAR-36 size, and larger, for industrial spot lighting and for airport markers.

12. Flashing neon tubes and brilliant kryton lamps of 50-million peak lumens for only 20 microseconds duration, add to the luminous approach markers of airports and guide all-weather flying.

13. Somewhat experimental but nevertheless promising, fluorescent street lighting has grown from the first American installation (1941) to some 25 trials (mostly abroad) involving over 900 lamps. Usage of 400-w mercury lamps in street lighting grew, mostly during 1948, to some 3,000 units in service.

14. All-louver-hung ceilings gained rapid acceptance in specialty shops, some schoolrooms, and some deluxe offices—especially where minimized glare was particularly desirable.



Priced to slash panelboard costs

Federal Noark NTPS and NTPR Panelboards are just the right depth for 4" partitions

TODAY'S LOWEST PRICED toggle switch panelboards are Federal Noark Type NTPS. They're also the smartest looking regardless of price.. precision-engineered for perfect control and protection of lighting and small power circuits.

Available in 4, 8, 12 circuits, NTPS Panelboards are of heavy-duty construction. Boxes are 3⅝" deep yet provide ample wiring space. Mounted in phenolic panelboard housings, branch circuit switches are quick-make, quick-break, double-break construction with silverplated switch parts. An auxiliary torsion spring insures positive contact pressure.

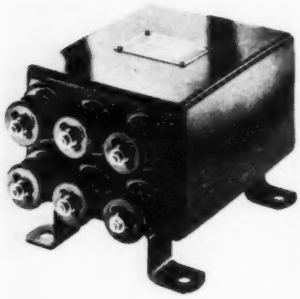
For more than 12-branch circuits—up to 40—specify NTPR Panelboards. They provide ample 4" gutters...have a necessary depth of 4¼". Other advantages, usually found on only the most expensive panelboards, are key lock, trim clamps and removable interior.

* Buy Type NTPS and NTPR Panelboards from your Federal Distributor. Write us for the "Federalog" describing the full line of Noark Panelboards. Federal Electric Products Company, 50 Paris Street, Newark 5, New Jersey.

FEDERAL NOARK
PANELBOARDS

Complete line of Federal Electric Products includes Motor Controls, Safety Switches, Service Equipment, Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct ★ Sales offices in principal cities.

NEW EQUIPMENT



Insulating Transformer

WITH an adequate range for accommodating low-frequency signalling circuits, voice band and carrier channels, an insulating transformer for carrier telephone is manufactured by F. W. Lynch Co, 149-151 Second St, San Francisco 5, Calif.

Designated as Model 230, this one-to-one ratio unit has features reported to include: Completely balanced windings; very low insertion loss and relatively flat response over a wide frequency range; rating of 10 kv (rms) at 60 cycles for one minute between windings or from either winding to grounded core and case; and weather-resistant steel housing.

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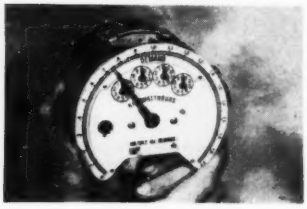


Demand Registers

DEMAND REGISTERS for use in industrial and commercial installations having comparatively light loads have been announced by General Electric Co's Meter and Instrument Divisions, Schenectady 5, N. Y.

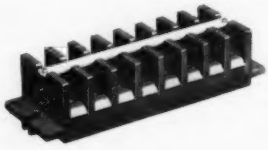
Reported to be of simplified construction, with fewer parts than previous designs, the registers are available in the indicating type, M-30 (illustrated) or the cumulative type M-31. The latter type has, in addition to an indicating dial, a set of dials for accumulating kwhr demand from one reading period to another. Both registers can be used to convert new General Electric watthour meters into watthour demand meters.

Bulletin GEC-272 describes Type M-31 and Bulletin GEC-413, Type M-30.

•

Terminal Blocks

PLASTIC electrical terminal blocks have been designed by The Wama Co, Baltimore 2, Md., to conveniently provide for an unlimited number of circuit terminations and at the same time eliminate wasted points. According to the manufacturer, these Add-A-Point blocks are suited for junction box, steel panel,



machine tool and switchboard mounting for temperatures not higher than 150 C.

Assembly consists of joining blocks together and securing each successive unit with a short screw. Marking strips and covers may be attached with a minimum of effort.

Rated at 60 amp, these terminal blocks are reported to be safe for up to 750-v operation.

•

Arc Welder Control

REMOTE CONTROL and a new circuit for reducing radio interference have been incorporated into Missing Link automatic arc stabilizers by Mid-States Equipment Corp, 2429 S. Michigan Ave, Chicago 16, Ill.

The new circuit markedly reduces r-f radiation, according to the company. In addition, the remote control feature automatically interrupts operation when the arc is broken, thereby eliminating radio interference during "idling" time. Operation is resumed by

means of a finger-tip switch mounted on the electrode.

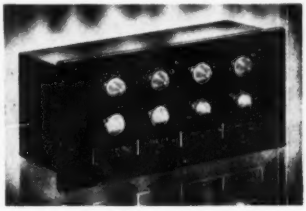
Missing Link units, with circuit and remote control optional, may be used for metal arc, gas shielded arc, carbon arc, Heliarc or spot arc welding operations with a-c or d-c, bare or coated welding rods.

•

Signalling System

DESIGNED to effect safety shut-downs, sequencing or interlocking of plant operations, multiple signal and alarm systems, designated as Panalarms, are manufactured by Panalarm Products, Inc, 7218 N. Clark St Chicago 26, Ill.

During normal operations all lamps glow dimly. To indicate an abnormal



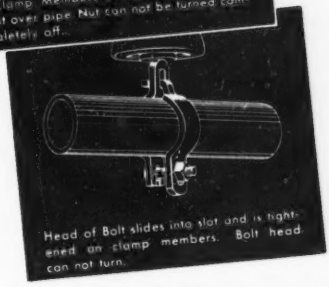
condition, two signal lights burn brightly and a sound warning device goes off. Several combinations of lights and signals are available to indicate (1) the trouble line, (2) when corrective measures have been taken, and (3) when the line is cleared.

Panalarm cabinets are made in multiple units up to 12 in a single cabinet, recommended for flush mounting on

Labor Saving—

HUBBARD ONE BOLT TYPE LAMP LEAD BRACKETS

Clamp Members swing apart freely to fit over pipe. Nut can not be turned completely off.


Head of Bolt slides into slot and is tightened on clamp members. Bolt head can not turn.

Hubbard Research and Development Engineers have, by their own volition, established a sort of "Sword of Damocles," which they like to imagine is hanging over their heads, and which bears the related admonitions—"Greater Efficiency!"—"Fewer Parts!"

Consequently, they strive to follow these directions in every new design which they conceive, and are constantly reviewing old products to improve, if possible, their original thinking. The Lamp Lead Brackets illustrated above are but one of many items which have kept the sword from dropping. "Greater Efficiency" and "Fewer Parts"—Both characteristics have been built into Numbers 180, 181, 157 and 158.

HUBBARD AND COMPANY

PITTSBURGH CHICAGO **OAKLAND, CALIF.**

central control panels or for wall mounting in any desired location. Systems are completely wired and require only wiring connections to terminal blocks for installation. Bulletin 300 Series explains in detail various types and applications of Panalarms.

•

Plastic Wire Guards

SPIRAL GUARDS of lightweight Tenite, manufactured by Western Electric Co. 195 Broadway, New York 7, N. Y., may be used to protect conductors from the abrasive action of tree trunks, limbs and branches. S-shaped aluminum clips lock the guards in place.

Tenite is claimed to be exceptionally tough and resilient, to hold close tolerances under varying weather conditions, and to have good aging qualities.

•

Paving Breaker

AN electrically operated paving breaker, reported to hit a harder blow than the largest pneumatic breaker, has been announced by Homelite Corp, Port Chester, N. Y. Both the 84-lb breaker

and its 129-lb, 110-v a-c gas-engine-driven generator can be transported in the trunk of a car.

The breaker is stated to be unaffected by dust or abrasive particles. A floating cylinder prevents the transmission of shock to the driving mechanism.

Box Connectors

TO CONNECT metallic or non-metallic sheathed cable to outlet boxes, cadmium-plated steel box connectors are available from Buchanan Electrical Products Corp, 1290 Central Ave, Hillside, N. J.

Installation is accomplished by hooking bottom tab into knockout and swinging connector to engage rocking clamp. Provision is made for simultaneous clamping of connector onto cable and into box by tightening two screws. No locknuts are required.

Both No. B267 (armored cable) and No. R267 (loom-wire or non-metallic sheathed cable) have smooth, rounded wire entry ways. Approval by Underwriters' Laboratories and Canadian Standards Association is listed for use on cable sizes 14/2, 14/3, 14/4, 12/2, 12/3 and 10/2.

•

Load Visualizer

FOR USE on single-phase and balanced polyphase systems, an a-c load visualizer has been developed by the Meter and Instrument Divisions of General Electric Co. Schenectady 5, N. Y.

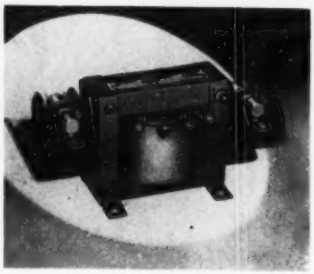
Rated as a standard 0—2.5/5-amp ammeter and a 0—150/300/600-v voltmeter, this instrument may be used with the calculator furnished to determine watts, vars, volt-amperes and power factor for load surveys, induction motor tests and studies and checks on power and lighting circuits.

Bulletin GEA-4784 contains additional information on this AF-1 load visualizer.

•

Control Transformer

A CONTROL CIRCUIT TRANSFORMER designed for use with industrial control equipment having high, momentary inrush currents to a-c operating magnet coils is being produced by Square D Co, Industrial Controller Division, 4041 N. Richards St, Milwaukee 12, Wis. The manufacturer advises that low impedance values of the transformer windings result in good transformer regulation during peak current periods.



To provide secondary circuit protection, either one or two fuse and bracket assembly units may be mounted on the transformer. Ratings and specifications are contained in Bulletin 215.

•

Insulation Testers

DESIGNED for insulation testing on larger generators, transformers or long lead-covered cables, irrespective of capacity or inductance, five models of a Standard Megohmer insulation tester are produced by Herman H. Sticht Co, Inc, 27 Park Place, New York, N. Y. Ranges are available up to 2,000 megohms; test potentials are either 500 or 1,000 v d-c.

All testers have constant pressure-slip-clutch type d-c generators and true cross-coil ohmeter movements with cobalt magnets. Supplied with 12-ft rubber covered leads and a leather carrying strap, the instruments weigh between six and nine pounds and measure 5 x 5 x 8 in. or 5 x 5 x 10 in. Bulletin 455 contains specifications and further information.

•

Industrial Fixture

DESIGNED to accommodate new 75-w, 96-in., T-12 Slimline lamps, the Silv-A-King two-lamp industrial unit is available from Bright Light Reflector Co. Inc, Bridgeport, Conn.

PINCO NO. 1510 SPECIFICATIONS:
Dry Flashover: 60,000 volts. Wet Flashover: 35,000 volts.
Leakage Distance: 7". M. and E. Strength: 10,000 lbs. min.

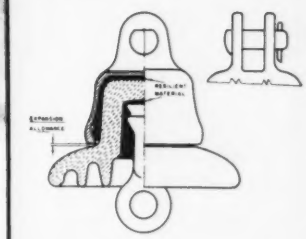
A typical dead-end application of Pinco No. 1510's, with Pinco No. 4350 Clamps.

Dead-Ending Troubles Are Over When You Use Pinco No. 1510's

INSTALL these *high strength* suspension units and you'll never have to explain to irate customers that line trouble due to dead-end insulator failure can be very hard to locate.

For Pinco No. 1510's need no excuses. Especially popular for dead-ending and guying because of their unusual strength-for-size, they've rolled up millions of service-years without replacement for electrical or mechanical failure.

Having thus proved that they're *RIGHT on the job,* Pinco No. 1510's are the right insulators for *you* to specify and buy.



"High Strength"

The Pinco No. 1510 does NOT attain its extraordinary strength through increased metal or porcelain bulk. Instead, Pinco design reduces cap weight and insures the most favorable volumetric relationship between porcelain and metal because of the special properties of these two materials:

PINCO PORCELAIN . . . wet plastic process, non-porous, homogeneous, tops in electrical, mechanical strength.

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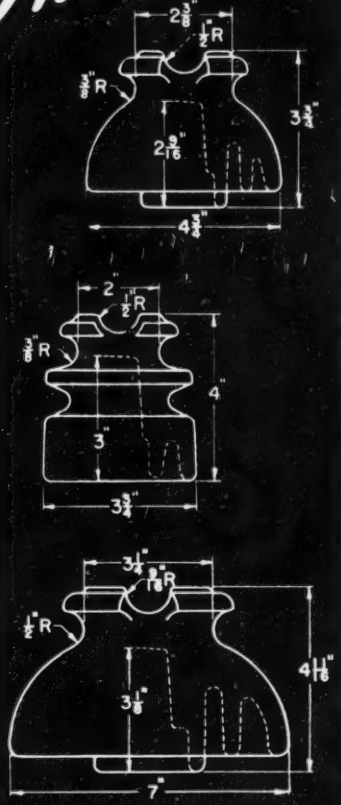
J-D

LOW VOLTAGE PIN TYPE *Insulators*

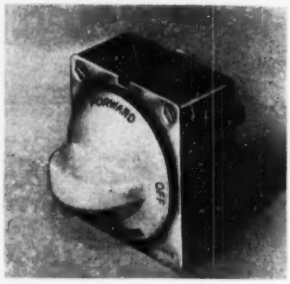


Write for Bulletin No. 500

JEFFERY-DEWITT INSULATOR CORP.
KENOVA, WEST VIRGINIA
U. S. A.

Features of the fixture include: E-Z Lok reflector attachment for ease of assembly or disassembly from the hood; slide-grip grooves and hangers which assure versatility of installation. Because T-12 lamps are of the instant-start type, the need for starters in this fixture has been eliminated, according to the manufacturer.

•



Reversing Switch

A MANUALLY OPERATED, four-position motor reversing switch rated to ¼ hp, 25 amp, 115 v, for a-c operation only, has been developed by the Hart Mfg Co, Hartford, Conn. Available in either uni-directional or bi-rotary types, Model 53815 is designed for household appliance control. It measures 2⅜ x 2⅛ x 1¾ in.

•

Voltage Regulator

WITH a rated output up to 250 va, a portable voltage regulator of the instantaneous, electronic type is announced by The Superior Electric Co, 24 Hannon Ave, Bristol, Conn. Listed as the IE51002, the unit is said to deliver a constant output voltage regardless of variations in input voltage or load current.

Output is adjustable between 110 and 120 v for a rated input of 95 to 135 v. The unit is equipped with a six-foot cord, two output receptacles and a pair of five-way binding posts.

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Because They're { **Easy to Use**
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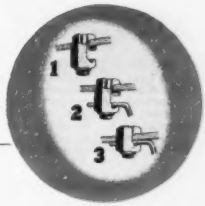

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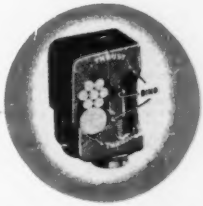
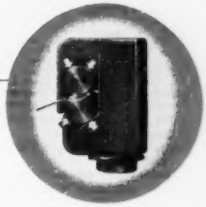
One bolt to tighten — always engaged — no time lost starting a nut — no chance of cross threading — no loose parts to lose.



Vibration-proof bind

Inside thrust action against the vise-type sleeve of the connector results in the vibration-proof bind of Fargo Connectors.



High Pressure at wire contact

Every inch-pound of wrench pressure develops 10 lbs. or more compression between conductors, resulting in high conductivity. The V-Groove jaw guarantees four points of contact with conductors.

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1300 Series

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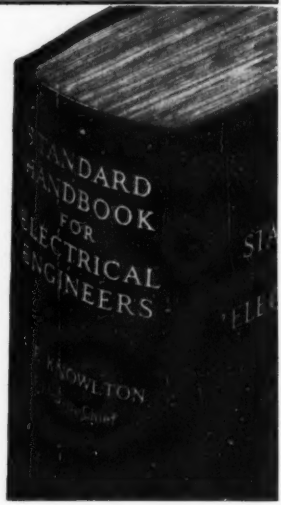

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MORE NEW PRODUCTS
about which you should know

John C. Dolph Co, Dept 10, 1060 Broad St, Newark 2, N. J., has produced two clear **baking varnishes**, Synthite BC-301 for transformer coil insulation and Synthite BC-302 for insulation of all types of wound coils. . . . General Controls Co, 801 Allen Ave, Glendale 1, Calif., manufactures an electric diaphragm **gas valve** for controlling natural, manufactured and liquified petroleum gases. . . . Martin Mfg Co, 108 E. Fourth St, Los Angeles, Calif., is offering a rolled steel, universal **wire stripper** for use on wire sizes 8 to 30.

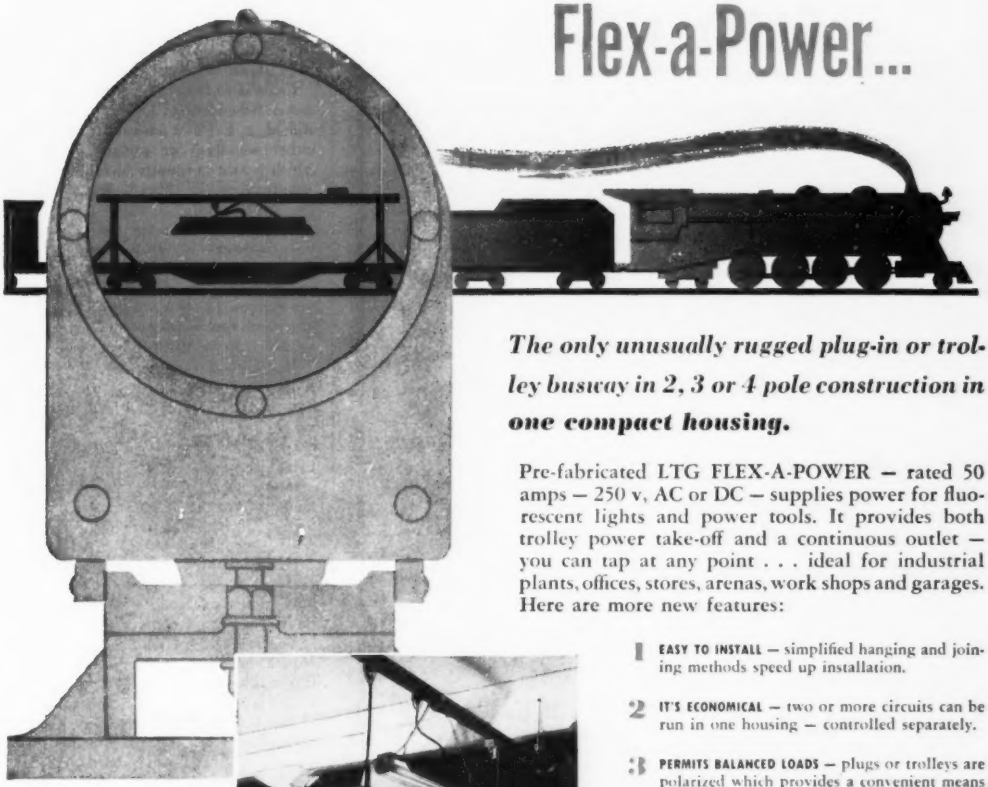
Carrier Corporation, Syracuse, N. Y., announces a 1-hp capacity, console type room **air conditioner** that is said to perform quietly and require little maintenance; has two-speed fan and operates on 230/208-v, single-phase, 60-cycle supply. . . . The H. R. Kirkland Co, Morristown, N. J., has designed a **paging service**, the Visicall System, for installation where extreme noise conditions exist. . . . Minneapolis-Honeywell Regulator Co, Brown Instruments Division, produces an automatic, electronic, oil drill **bit weight control** consisting of strain gauge assembly, electronic potentiometer and pneumatic brake.

General Scientific Equipment Co, 2700 W. Huntingdon St, Philadelphia 32, Pa., has headrest **goggles** with lenses in shades 3 through 6 for use during welding, cutting and brazing operations. . . . Slater Electric Mfg Co, Inc, Woodside, N. Y., manufactures a combination 3¼ and 4-in. keyless **ceiling receptacle** (5-in. diam.) made of white urea or brown bakelite. . . . Westinghouse Lamp Division, Bloomfield, N. J., has developed two 75-w medium screw base **lamps** in PAR-38 bulbs, a projector-spot and projector-flood, which operate on 115-125-v circuits.

British Industries Corp, 315 Broadway, New York, N. Y., has available a non-corrosive **rosin flux** called Resin Flux in liquid form. . . . Gits Brothers Mfg Co, 1846 S. Kilbourn Ave, Chicago 23, Ill., produces a factory assembled **seal unit** designed for horizontal and vertical rotating shafts. . . . Irvington Varnish & Insulator Co, Irvington 11, N. J., announces an internal-curing **insulating varnish**, Harvel 1012C, for the treatment of windings subject to great stresses and strains. . . . Whiting Corp, Harvey, Ill., has a weatherproof, full-vision **crane cab** with magnetic switching controls.

The Electric Storage Battery Co, Philadelphia 32, Pa., has developed the Exide-Manchex **storage battery** which is

You get 6 big advantages with New LTG Flex-a-Power...



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Pre-fabricated LTG FLEX-A-POWER — rated 50 amps — 250 v, AC or DC — supplies power for fluorescent lights and power tools. It provides both trolley power take-off and a continuous outlet — you can tap at any point . . . ideal for industrial plants, offices, stores, arenas, work shops and garages. Here are more new features:

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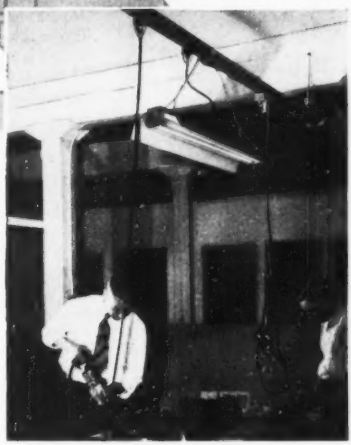
3. **PERMITS BALANCED LOADS** — plugs or trolleys are polarized which provides a convenient means of balancing loads.
4. **IT'S REALLY RUGGED** — rigid construction of housing itself prevents sagging — only 2 hangers needed for each 10 ft. section.
5. **MORE FLEXIBILITY** — standard fittings such as elbows and radius sections permit economical custom installations — easy to disassemble and relocate.
6. **GREATER CONVENIENCE** — trolley with silver alloy contacts may be inserted or removed at any point along the run — no "drop-out" section required.



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suitable for control bus and switchgear operation. . . . The Wilbur & Williams Co, Boston 15, Mass., has a chemical pretreatment and **primer** called Rust-O-Primer for application to wet or dry, clean or rusted metals, including steel and aluminum. . . . H-R Electric Co, Dearborn, Mich., announces a 15-amp 5-in-1 **plug fuse**, approved by UL, which has positive snap action provided by a bronze contact spring.

General Electric Co, Switchgear Divisions, Schenectady 5, N. Y., has designed a Form A **drawout relay** for either semiflush or surface mounting which is said to simplify installation and maintenance. . . . Flag-It Wire Marker Co, 220 Rose St, Los Angeles, Calif., is producing self-adhesive black-on-white **wire markers** 7/8 in. long and 3/8 in. wide for tagging up to 0.2-in. diam wire. . . . Square D Co, 4041 N. Richards St, Milwaukee 12, Wis., manufactures an electronic **spot welder control** operating on 115, 220 or 460 v, 50/60 cycles.

H. Childs & Co, Inc, Iron Age Division, Pittsburgh 22, Pa., produces a horsehide **safety shoe** without nails for use where the danger of electric shock exists. . . . Irvington Varnish & Insulator Co, Irvington, N. J., has available **plastic tubing** for continuous use at temperatures up to 105 C. . . . The Alpha Corp, Greenwich, Conn., produces a **dry lubricant** and anti-seizing compound of molybdenum-disulfide powder, called Molykote, claimed to have high film strength, low coefficient of friction and tenacious adherence.

The Trindl Co, 17 E. 23rd St, Chicago 16, Ill., has developed a portable, electronic **thawing device** for thawing frozen water pipes which operates on 110 or 220-v, 50/60-cycle supply. . . . O. Z. Electrical Mfg Co, 262 Bond St, Brooklyn, N. Y., is offering all bakelite **insulating bushings** which are reported to be 36% stronger in torque, 440% more impact resistive and 112% greater in tensile strength; range in size from 1/2 to 6 in.; have UL approval. . . . Pyramid Instrument Co, 117 Lafayette St, New York, N. Y., announces the swivel-mounted Flexmount **pyrometer** available in all standard ranges.

Crane Co, 836 S. Michigan Ave, Chicago 5, Ill., has designed a self de-icing **hydrant** utilizing a collapsible rubber tube inside the riser spout which will deliver water in cold weather. . . . Tempil Corp, 132 W. 22nd St, New York 11, N. Y., has available **temperature indicating products** in crayon, liquid or pellet form for 12½-deg intervals from 113 to 450 F; for 50-deg increments from 400 to 1600 F, crayon and liquid; and pellet form to 1700 F. . . . Texas Foundries, Lufkin, Texas, manufactures a malleable **iron**, ribbed plate-type **anchor** which uses standard rods and installation **tools**.

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Transformer Oils
WHILE ENERGIZED
. . . . Lowers Maintenance Costs
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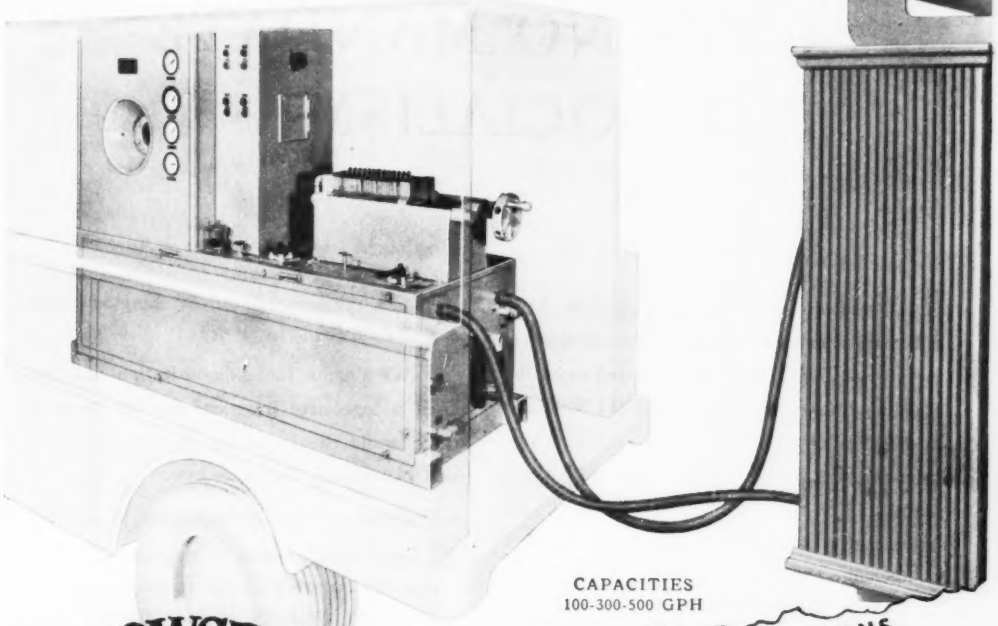

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LIQUID CONTROL SPECIALISTS SINCE 1885

The Election of November 2, 1948 GAVE NO MANDATE FOR SOCIALISM

The President and those who support his legislative program have objected to the substance of my previous editorial, which appeared under this headline: "Now is the Time to FIGHT SOCIALISM in Washington."

In that editorial I explained how Washington is poised to follow the disastrous policy of forcing industry to skimp on new plants and new equipment. That policy landed Britain in the numbing embrace of the Socialists. I cited the experience of Britain to show how such skimping on industrial tools can bring a nation to economic stagnation . . . and Socialism.

The President, in his recent Jackson Day speech, brushed aside this warning . . . "They are again trying to frighten the people with the old worn-out bugaboo that Socialism is taking over in Washington." Senator Francis J. Myers of Pennsylvania asserted that I was guilty of "warfare against any reasonable effort to keep our system of free enterprise working."

These criticisms may be sincere. But they are not well-founded.

I want to show why they are not well-founded by basing this editorial on Washington rather than Britain.

In Washington the Administration has proposed a legislative program, the key parts of which would clearly put the country far on the road to Socialism. Let us see how.

There are two steps in the process:

FIRST: The government by its taxation program undermines private industry so that it cannot provide itself with the necessary new plant and tools.

SECOND: The government itself steps in to provide the plants and equipment that it has blocked industry from getting. *That is Socialism.*

Here is how Washington is promoting Socialization of the steel industry—and of other industries.

Steel has been expanding its capacity and improving its equipment chiefly by plowing back its profits. During the last three years it has spent $1.4 billion for new plants and new tools. That was more than the companies had available from their own earnings. But profits provided more

continued on next page

than half of that money – more than $700 million. The remainder came from loans and from depreciation reserves set aside out of the earnings to replace worn-out equipment.

Profits must continue to provide the funds needed to pay for the bulk of the steel industry's necessary expansion. That is because private citizens, their income slashed by heavy taxes, have not been willing to buy steel stocks even at prices ruinously low for the companies and their present stockholders. The stock market currently prices the mills and other facilities of the nation's principal steel-producing companies at far less than fifty percent of the cost of reproducing them.

Let us take another example. Profits are essential to expansion in the electric light and power industry also. This year private companies are planning to buy $2 billion worth of new plant and equipment. To do that without going overboard in debt, they must sell to the public some $300 million worth of common stock. A squeeze on their profits would make that sale virtually impossible.

For tens of thousands of small business enterprises profits afford virtually the only practical source of funds for new equipment and expansion.

In the face of these and many other examples that might be cited, what is the most effective way to prevent industry from re-equipping itself and expanding is capacity to meet our essential needs?

Obviously, it is to cut down profits. And that is what the Administration is trying to do. The President has declared that steel prices are too high, and is demanding that Congress raise taxes sharply on all corporations.

There you have the first step toward socializing industry.

Next comes step two. Have the government supply the tools and equipment which, by taxation, it prevents industry from getting.

The Administration has proposed legislation to carry out this second step. It is called the "Economic Stability Act of 1949," for short, the "Spence Bill."

This bill gives the President the power to provide industrial facilities – in steel, power or any other industry – where he finds that a shortage is hampering or is likely to hamper the economy.

True, the bill says that the government is not to construct new plants if private companies will do it through government loans, on terms prescribed by the President. That may be just one step short of complete socialization. But it is only a short step. And the Spence Bill authorizes the government to take that step.

By itself, the Administration's "Stability Act" sounds harmless enough. It would have the government build plants only as a last resort. But it provides also that if private enterprise cannot turn out all the goods the country needs, the government can and should step in and provide the equipment to do it.

Now, take that power together with an Administration tax program that undercuts the ability of private enterprise to supply the new plants and equipment it needs out of its own earnings. That combination promotes government ownership and operation of industry.

And that is Socialism.

The American people, of course, have the right to live under any system they choose—Capitalism, Socialism, Fascism, Communism, or what-have-you. But before Socialism or any other "ism" is imposed upon us from above, the people should know the facts. If this editorial shall have contributed in some small degree to that end it will have served its purpose.

The election of November 2, 1948 gave no mandate for Socialism.

President, McGraw-Hill Publishing Company, Inc.

NEWS ABOUT PEOPLE

Helfter to Direct Steam Plants for Buffalo Utility

Franklin S. Helfter, superintendent of the Charles R. Huntley steam-electric stations of the Buffalo Niagara Electric Corp, Buffalo, N. Y., has been appointed general superintendent of steam stations of the company. In this capacity, Mr Helfter and his staff will have general supervision of the Dunkirk steam station now being erected, as well as the Huntley plant.

FRANKLIN S. HELFTER

Mr Helfter will be assisted by William G. Godfrey, assistant superintendent. Steam operations of the combined plants will be under the direction of Daniel P. Wendel and electrical operations under Elmore W. Popp. P. Allister Burt of the Huntley steam electric stations has been made station superintendent of the new Dunkirk plant.

Mr Helfter is a veteran of 26 years in the utility business. He joined the Buffalo company in 1923 in the meter department and progressed through successive steps in the construction, electrical and mechanical engineering departments, becoming assistant superintendent at the Huntley station in 1939. In 1947 he was made superintendent of the stations.

Mr Godfrey became identified with the company in 1929 as a design engineer in the engineering department. It was in 1947 that he became assistant superintendent at the Huntley stations.

Mr Wendel joined the Buffalo utility in 1918 and Mr Popp in 1916.

Mr Burt has been with the company since 1930, during which time he has worked as engineering field clerk on construction, electrical maintenance, and equipment control maintenance and as technician and assistant results superintendent. He is now on special operational studies as assistant to the superintendent of Huntley stations.

•

West Penn Power Makes Engineering Appointments

J. E. Fife, formerly manager of the northern division of the West Penn Power Co at Kittanning, has been appointed manager of power supply. He will be responsible for system planning and system operation and will supervise the electrical engineering and the electrical construction and maintenance of power stations and substations. Mr Fife has been with West Penn almost 30 years, most of which were spent in the power department. Howard S. Fitch, who has recently been made vice-president in charge of the power department, in announcing the department's set-up, said J. E. Thomas continues as manager of power production and J. M. Connor as manager of mines.

To fill the position left vacant by Mr Fife's promotion, Joseph O. Chambers, vice-president in charge of the operating department, has announced appointment of R. W. Hurd, western division manager at Washington, Pa., as manager of the northern division, succeeding Mr Fife, and of D. T. Faust, district manager at Brownsville, as western division manager at Washington.

•

J. J. McLean, formerly city electrical engineer, has been appointed city light superintendent at Port Angeles, Wash., to succeed B. W. Lean, whose resignation was recently announced.

Charles F. Monson, assistant to the vice-president of the Puget Sound Power & Light Co at Seattle, Wash., since 1943, has been promoted to the position of assistant superintendent. He reports to Charles Terrell, vice-president in charge of operations. Mr Monson joined Puget Power as a student engineer in 1939, becoming an executive office clerk in 1941 and junior engineer in 1942.

Bateman Assumes Broader Duties in Los Angeles

Announcement has been made of the appointment of Ivan L. Bateman as electrical engineer in charge of the power operation and maintenance division of the Los Angeles Department of Water and Power. He succeeds H. L. Caldwell, retired.

IVAN L. BATEMAN

Mr Bateman, who has been assistant division head since 1946, joined the bureau in 1926. After a short association with the Bell Telephone Laboratories in New York, he returned to Los Angeles in 1929. He has served as communication engineer and distribution engineer.

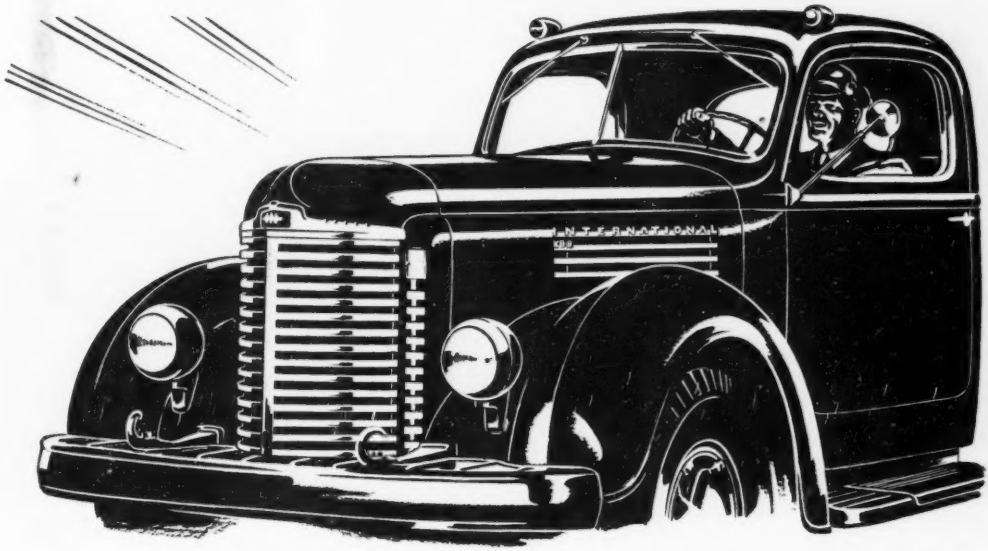
•

W. H. Jones, division superintendent at Morton for the Philadelphia Electric Co, has been made purchasing agent of that utility.

Carter B. Withers has been appointed superintendent of the new $12,000,000 Willow Island power generating station of Monongahela Power Co near St. Mary's, W. Va. The station is nearing completion.

Wilbert D. Gorman, illuminating engineer, Hartford Electric Light Co, Hartford, Conn., will retire on April 1 after 40 years of service. Mr Gorman plans to establish a consulting illuminating engineering office in Hartford. He was guest of honor at a dinner of the Connecticut section of the Illumin-

First in heavy-duty truck sales for 17 straight years!



America's most exacting truck buyers AGAIN give Internationals a vote of confidence!

Actual 1948 registration figures for new trucks of 16,001 pounds and greater GVW ratings show this nationwide preference for Internationals:

Internationals	**26.4%**
Truck "B"	**14.3%**
Truck "C"	**13.3%**

This marks the 17th successive year that Internationals have led in heavy-duty truck sales! Would men who buy on a basis of performance give a No. 1 rating to any truck unless it gave them a No. 1 value?

Outstanding value—right down the line! The same basic values that have kept Internationals first for 17 straight years in the heavy-duty field, are yours in any International Truck model. Heavy, light, or medium-duty, your International Truck is *all* truck. There's no compromise with passenger car design.

Trucks built to meet your requirements. Among the 22 basic International Truck models and 1,000 different truck combinations, there's a truck that's right for *your* job. In the range of gross weight ratings, from 4,400 to 90,000 pounds, you get the power, the frames, the axles you need for efficient hauling.

PLUS—the nation's largest exclusive truck service organization! 4,700 International Truck Dealers and 170 Company-owned Branches are ready with trained mechanics, precision-engineered replacement parts and low-cost rebuilt exchange units . . . ready to keep your International rolling at peak efficiency.

A truck transportation engineer is ready to help you! Call your nearest International Dealer or Branch, and find out how Internationals can step up the efficiency of your hauling. Trained International Truck transportation engineers will help you analyze your job—recommend a truck to lick it. If you're interested in profits, you'll call *soon!*

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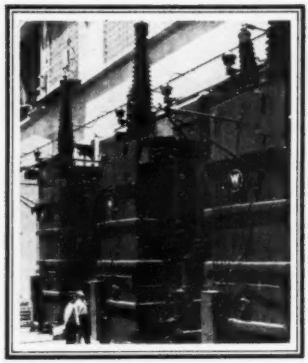
RELY ON ELECTRICAL CONTROLS TO SAVE YOUR LIFE?



BLAW-KNOX Fog Nozzles* are electrically controlled. When temperatures rise suddenly, and dangerously, or approach a point above a pre-set maximum, electrical contacts are closed, deluge valves operated, fog nozzles are turned on, pump motors started, alarms sounded, fire doors and other devices actuated.

Blaw-Knox Sprinkler Systems are as reliable as electricity—and as fast in action. Blaw-Knox offers fire protection systems especially designed for transformer banks and other special applications.

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STANDARD HEAD

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FOG NOZZLE

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SPRINKLER DIVISION
829 Beaver Ave., N. S.
Pittsburgh 12, Pa.

ating Engineering Society on Feb 24 attended by about 100 lighting engineers from eastern utility and manufacturing companies. Mr Gorman has been a regional vice-president of IES.

•

A. E. Papp Made General Manager, G&W Electric

Andrew E. Papp has been appointed general manager of the G&W Electric Specialty Co, Chicago, succeeding George P. Edmonds, who has retired after 38 years of service. Mr Papp has spent all of his industrial life with the organization, having joined the staff in 1929.

His first assignment was in the laboratory studying cable termination and switching problems. He subsequently became chief engineer, the position he held until his recent appointment.

Perhaps the two developments for which Mr Papp is best known are the "PK" switch and the "solder-tite" pothead.

•

A. M. Jacobs has been appointed chairman of the Electricity Supply Commission, Johannesburg, Union of South Africa, succeeding the late Dr H. J. van der Bijl. For the past 21 years he has been a member of the commission's board. He acquired early experience as an electrical engineer in Europe, the United States, South America, Java, South China, and Japan. He was made senior engineer of the Electric Supply Commission in 1925 and was appointed a commissioner (engineering) in 1927, becoming chief engineer in 1932 while still remaining on the board. Mr Jacobs is succeeded on the board by **Dr J. T. Hattingh**, consulting electrical engineer to the commission. Mr. Hattingh was on the staff of the General Electric Co in Schenectady for some years and returned to the Union in 1922, becoming technical assistant to Dr van der Bijl and later consulting engineer.

Richard H. Koehler has been appointed advertising manager of the Stearns Magnetic Mfg Co, Milwaukee, Wis. Mr Koehler was formerly advertising manager for Vincent-McCall Co, Kenosha, Wis.

W. C. Johnson has been appointed to the newly-created-position of vice-president in charge of sales of the Admiral Corp, Chicago. Mr Johnson has been in the radio and television field since 1928, and for the past two and one-half years had served as general sales manager. Other positions held by Mr Johnson since joining Admiral in 1944 were midwest regional sales manager and manager of field activities.

Pinco Assigns Executive Duties to D. H. Rowland

Davidge H. Rowland has been appointed assistant to the president of the Porcelain Insulator Corp, Lima, N. Y. Mr Rowland joined Pinco in 1945 as ceramic engineer and director of research. In his new position, he will continue as director of research.

Mr Rowland has been actively connected with the insulator industry for the past 26 years. Prior to joining Pinco, he was chief engineer and metallurgist for the McConway-Torley Corp, Pittsburgh, from 1941 to 1945.

DAVIDGE H. ROWLAND

OBITUARY

Luke R. Storey

Luke R. Storey, vice-president and general manager of the Home Gas & Electric Co, Greeley, Colo., died on March 3.

Mr Storey was appointed general manager in 1944 when the company returned to local control after a period under the Western Light & Telephone Co of Kansas City. He was instrumental in regaining control of the company for local interests after it was taken over by the Kansas company in the early thirties.

Born near Columbus, Kans., Mr Storey worked for DuPont Power Co, Mountain States Telephone Co, and the Denver & Rio Grande Railway early in his career. He arrived in Greeley in 1913 as a trouble-shooting lineman for Home Gas & Electric. He was made superintendent in 1917, when he turned his attention to rural electrification and pump irrigation. Mr Storey is a past-president of the Rocky Mountain Electrical League.

•

John R. Cox, who retired in 1945, following 53 years of service with the Quebec Hydro-Electric Commission and

its predecessors, died on March 14 at his home in Quebec. He was 71 years old. Superintendent of the Commission's city stations division, Mr Cox had witnessed the development of this branch of Hydro activities from two stations in 1907 to 12 at the time of his retirement.

L. H. Lund

L. H. Lund, vice-president and treasurer of the Westinghouse Electric Corp, died of a heart attack on March 14 at his office in Pittsburgh. He was 52 years old.

Mr Lund joined Westinghouse in 1921 when he entered the accounting department of the International company in New York, six months later being elected auditor. In 1937 he became assistant treasurer and assistant secretary of the parent company with headquarters in Pittsburgh. The following year he was also named credit manager, and in 1941 was elected treasurer. In 1945 Mr Lund was elected vice-president and head of the treasury department.

Elmore H. Schiemann, mechanical engineer, for many years associated with the Pioneer Service & Engineering Co, Chicago, died suddenly on Feb 11 on a train returning him to Chicago from a business trip to Pueblo, Colo. He was 48 years old. Mr Schiemann was a member of the American Welding Society and the American Society for Testing Materials.

Thomas J. Pace, retired executive of the Westinghouse Electric Corp, died on March 10 at Pittsburgh, Pa. He was 71 years old. Mr Pace became identified with Westinghouse in 1899. He served in the sales department, supply department, as general manager of purchases and traffic, and assistant to vice-president in charge of sales.

Gustav F. Braun, a senior design engineer with Thomas A. Edison, Inc, West Orange, N. J., died on March 12 at his home in Elizabeth after an illness of several weeks. He was 65 years old. Mr Braun was associated with the Edison organization for 20 years.

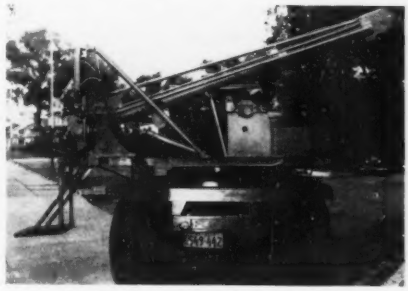
J. Wesley Barth, president of the White-Wayne Counties Rural Electrification Cooperative, Fairchild, Ill., died on March 1 at his home in Enterprise, Ill. He was 55 years old.

Col P. A. Frye, executive secretary of the Louisiana Public Service Commission, died suddenly on March 12 at his home in Baton Rouge.

Albert J. Kuester, electrical designer with Vern E. Alden Co, engineers, Chicago, died in that city on Feb. 22.

Build your **POLE LINES** *with modern equipment*

With the JAQUES *Hydraulically Controlled* **EARTH BORING MACHINE**



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4. Pole Setter, Winch and other extras available

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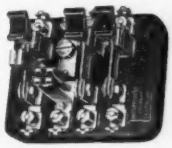
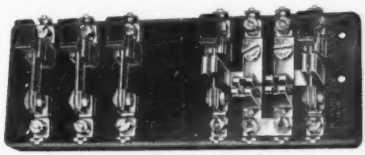
Long life, perfect action, speedy, safe . . . those words describe our attractive, highly developed knife type METER TEST SWITCHES for single or polyphase circuits. With or without covers, front or back connected.





#536 for front or back connection. Used frequently for relay circuits.

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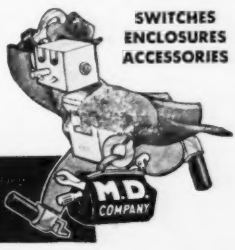
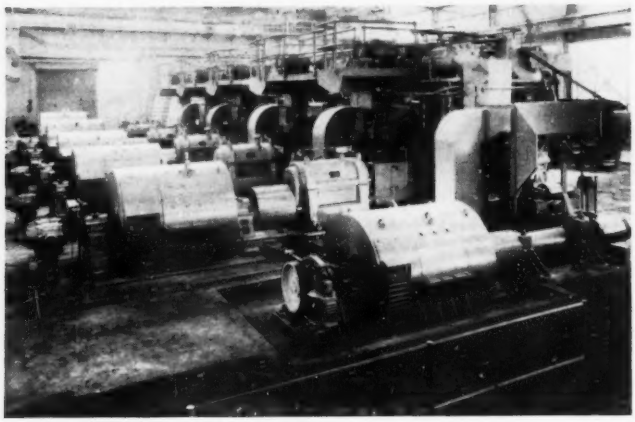


SWITCHES ENCLOSURES ACCESSORIES

METER DEVICES COMPANY · CANTON, OHIO

MANUFACTURERS and MARKETS



NEW COLD MILL, built by Acme Steel Co at a cost of $2,500,000, went into production recently. This highly integrated plant for the production of cold rolled strip steel, occupying an area of 56,000 sq ft, was placed on display for several hundred interested employees, who visited the precipitron, the motor room and electrical basement, and the oil basement. Illustration shows drive side of mill—five 1,250 hp motors. Motor in foreground for coiler is 300 hp

Sees Westinghouse Sales Holding at '48 Level

Westinghouse Electric Corp expects its business this year to continue near the high level maintained in 1948, Gwilym A. Price, president, revealed at a recent press conference. Discussing the outlook, Mr Price said, "I wouldn't be surprised if our billings dropped 10% this year. But I think there's just as much chance of their going up 10%."

Expressing optimism about the outlook for sales of major appliances, Mr Price said: "I think we'll do as much business in 1949 in refrigerators, washing machines, and ranges as we did in 1948, when output of those items was hampered by a shortage of sheet steel."

On heavy equipment, Mr Price said, "Prospects of sustained demand for industrial and power generating, distribution, and utilization equipment are encouraging. Our backlog on transformers for the utility industry runs into 1951." He admitted, however, that production is declining in some lines because "abnormal postwar demands have been filled."

"As supply catches up with demand," he continued, "more widespread and intensified selling efforts will be necessary . . . "

Production of small motors has been cut back substantially, said Mr Price. Other lines in which production has been cut back include motors of one to 15 hp, small distribution transformers, meters, radios, and small appliances. But these declines, according to Mr Price, will be offset by higher operations in the electronic and gas turbine divisions.

•

GE Turns Out 200,000 Television Sets Annually

Television sets are being made at the rate of 200,000 a year at General Electric Co's new Electronics Park plant in Syracuse, N. Y. More than 3,000 of the Park's 7,100 employees are working on television receivers or television station equipment, and 70% of the company's radio-television receiver business in 1949 will result from the sale of a wide variety of television sets, Dr W. R. G. Baker, vice-president, said.

"The industry will sell between 1,600,000 and 2,000,000 television sets in 1949, with billings at retail doubling the 1948 business," predicted Dr Baker.

Four Companies Awarded Grand Coulee Contracts

Secretary of the Interior Krug has announced contract awards totaling $8,949,470 for generating equipment designed to make Grand Coulee Dam, Wash., the greatest power producer in the world.

The contracts were for the last three of 18 generating units. The cost of adding them and the necessary switchyard and power plant changes will be about $16,000,000, Mr. Krug said.

Contracts awarded are as follows: Generators, $5,250,034, Westinghouse Electric Co; turbines, $2,497,950 Newport News Shipbuilding & Drydock Co, Newport News, Va.; transformer, $1,072,011, General Electric Co and governors, $129,475, Woodward Governor Co, Rockford, Ill.

Award of an order to General Electric for the last four 10,000,000-kva power switching units for the right switchyard at Grand Coulee has been announced by the USBR. Orders for the other nine similar units required for the yard had been placed earlier, also with GE. Because of the small quantity of oil required by this type of breaker the Bureau has eliminated all oil-handling equipment for the switchyard.

Rating of the impulse-type units will be 230 kv, 1,000 amp, suitable for 20-cycle reclosing at full 10,000,000 kva for one reclosure. First of the 13 units is scheduled for shipment in July, 1949.

•

Cuts Electric Motor Prices

Ohio Electric Mfg Co, Cleveland, has announced a reduction of 12½% in standard oil burner electric motors to quantity buyers in order to meet competitive conditions. The ⅓ and ⅛ hp motors are used to power pressure oil burners. New prices, already in effect, are $11.50 on the ⅛-hp motors and $11.75 on the 1/6-hp units.

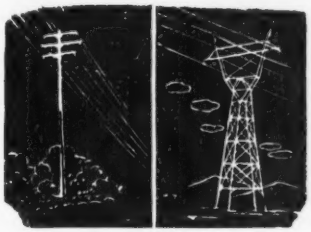
•

Hotpoint Dealer Guides

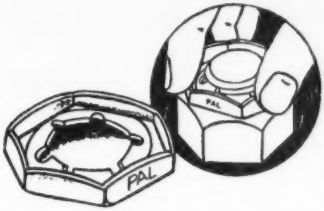
A new dishwasher sales promotion plan book, part of a continuing program "to build dealer profits through increased sales of 1949 dishwashers," has been developed by Hotpoint, Inc, Chicago. A short cut to kitchen and

ELIMINATE RE-TIGHTENING OF NUTS

On Steel Tower and Wood Pole Lines



Specify PALNUTS on new lines
Add PALNUTS to existing lines



For over 10 years, Double Locking PALNUTS have been keeping bolt-and-nut assemblies tight on steel towers, wood pole lines, cross arms and braces, insulator pins, clevises and clamps.

When applied on new installations, PALNUTS save future checkups and re-tightening. Maintenance crews checking old installations can add PALNUTS without disturbing regular nut. Only 3 bolt threads space are required. PALNUTS are very low in cost; may be removed and reused. They are available in a full range of sizes, in Hot Dipped Galvanized or other finishes and materials used by the Utility industry.

SEND details of your needs for samples. Write for PALNUT literature and detailed folder on power line applications.

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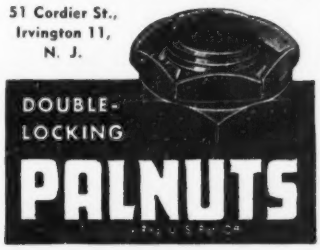

home laundry planning in the form of a simplified guide, designed so that the consumer can lay out scale appliance groupings in his own home, has also been made available to Hotpoint dealers.

Screw Threads Standard Gets ASA Final Approval

The American Standards Association has given its final approval to a new American standard which puts into effect the unified screw thread system agreed upon by Great Britain, Canada, and the United States by the declaration of accord signed in Washington last November.

This American standard, Unified and American Screw Threads for Bolts, Nuts, and Other Threaded Parts, B1. 1-1949, presents in tables, diagrams, and formulas the dimensions of the Unified Threads, as well as those threads which for the time being remain standard in the United States alone.

The British Standards Institute and the Canadian Standards Association are working on similar standards to put the unification plan into effect in their countries.

Manufacturers Make New Sales Assignments

Electrical manufacturing companies have recently made the following appointments to their sales staffs:

Allis-Chalmers Mfg Co has appointed J. H. Burrus manager of its Portland (Ore.) district. He succeeds F. V. Sams, who has retired after 43 years service with the company. Mr Burrus was formerly assistant manager in Portland.

Apex Electrical Manufacturing Co., Cleveland, has named Robert E. Mahaffey district sales manager in seven northeastern Ohio counties. He will supervise sales in Stark, Holmes, Tuscarawas, Ashland, Richland, Wayne, and Carroll counties.

Clarostat Mfg Co., Dover, N. H., has appointed A. R. Thibau, 402 Manufacturers Exchange Bldg, Kansas City 6, Mo., sales representative. Mr Thibau will cover all of Kansas, all of Nebraska, western Missouri with the exception of Jefferson City, and Iowa with the exception of Waterloo, Cedar Rapids, Sioux City, and Fort Dodge.

Swivelier Co., New York, Inc, has appointed Herbert C. Zang, 838 Starin Ave, Kenmore 17, N. Y., to cover New York State, north of Poughkeepsie. In addition to its present territory, the George Butler Co of Chicago will now cover the entire states of Wisconsin, Minnesota, and North Dakota, also Michigan's Upper Peninsula. The Northwestern Agencies, Inc, 4130 First Ave. South, Seattle 4, Wash., will cover, in addition to their present territory, the states of Montana and Idaho.

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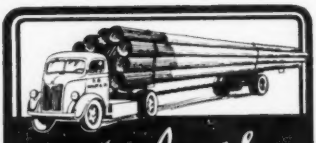

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TOLEDO 4, OHIO

NEW ELECTRICAL CONSTRUCTION

A weekly selection of U. S. electrical construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is indicated or implied

UTILITIES

Proposed Construction

Arizona and Nevada—Bureau Reclamation, Dpt. Interior, Aviola Bldg., P. O. Box 392, Phoenix, Ariz., 34,500 volt Yuma-Mesa Switching Station at Yuma, Ariz., on lots 18, 19 and 20 on 11 Ave. south of 10 St., Spec. 2604. L. N. McClellan, Bldg. 1-A, Denver Federal Center, Denver, Colo., ch. engr.

Conn., Hartford—Hartford Gas Co., 233 Pearl St., brick, concrete gas conductor, precipitator and sub-station bldgs., Front St., **$130,000.**

Georgia—Excelsior Electric Membership Corp., Metter, 129 mi. rural distr. lines, Candler Co., **$129,000.**

Idaho and Montana—Idaho Power Co., Boise, Idaho, 93 mi. high voltage transmission line from Armstead, Mont., to Salmon City, Idaho. **$650,000.**

Iowa—Grundy County Rural Electric Co-operative, Grundy Center, 44 mi. rural distr. lines, sys. imprvs., Grundy Co. **$340,000.**

Iowa — Woodbury Co. Rural Electric Co-operative, Moville, rural distr. lines, Woodbury, Ida, Plymouth and Monona Counties, **$483,000.** Scott Engrg. Co., Watertown, S. D., engrs.

Minn., Fergus Falls—Otter Tail Power Co., C. Wright, gen. mgr., Fergus Falls, 15,000 kilowatt generating plant, Hoot Lake, near Fergus Falls, **$3,000,000.**

Mississippi — Jones County Electric Power Assn., Laurel, 233 mi. rural distr. lines, sys. imprvs., headquarters, Jones Co. **$985,000.**

Nebraska — Niobrara Valley Rural Power Dist., O'Neill, 2½ mi. rural distr. lines village of Verdel; acquisition and rehabilitation of generating plant and 2 mi. lines in village of Verdel; 32½ mi. new rural distr. lines, sys. improvs. completion previously approved constr., Boyd Co. **$157,000.** Henningson Eng. Co., Standard Oil Bldg., Omaha, consult. engr.

N. M., Los Alamos—U. S. Atomic Energy Comn., Joseph R. Turan, Chief Contract Branch, Los Alamos, radio transmitter station and transmission line, Inv. No. 291-49-86.

N. Y., Newburgh—Central Hudson Gas & Electric Corp., South Ave., Poughkeepsie, steam plant to generate 50,000 to 60,000 kw of electricity at Dannskammer Point on west side of Hudson 4 mi. north of here. **$1,000,000.**

North Dakota — Dakotas Electric Co-operative, Bismarck 206 mi. rural distr. lines and new substation facilities, Burleigh Co. 7,500 kw steam generating plant at Beulah. **$4,033,000.**

North Dakota—Slope Electric Co-operative, Inc., New England, 681 mi. rural distr. lines, Slope Co. **$681,000.** REA allot. Ulteig Engr. Corp., 1114½ Front St., Fargo, engr.

N. D., Grand Forks—Minnkota Power Co-operative, Grand Forks, electrical work for power plant, Ellerbe & Co., 1st Natl. Bank Bldg., St. Paul, Minn., engrs.

South Dakota—McCook Electric Co-operative, Salem, 207.75 mi. rural distr. lines, McCook Co. **$200,000.** United Eng. Service, Kasota Bldg., Minneapolis, Minn consult. engr.

Tennessee—Fort Loudon Electric Co-operative, Madisonville, 170 mi. rural distr. lines and other sys. imprvs., Loudon Co. A. D. McWhorter, Jr., 212½ Union Ave., Nashville, engr.

Tex., LaPorte—U. S. Eng., 606 Santa Fe Bldg., Galveston, radar station control center near here, for Texas Air National Guard, c/o Lt. Col. J. D. Nottingham, Ellington Field. $500,000. Mills & Petticord, 3308 14 St. N.W., Wash., D. C., archts.

Tex., Corsicana—Navarro County Electric Co-operative, Inc., Corsicana, plans by J. E. Metcalf & Son, Corsicana, brick, concrete, steel REA storage and administration bldg. **$100,000.**

Washington—Bureau Reclamation, Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, Colo., control cubicle for station-service generator LS3, Grand Coulee Left Power Plant, Columbia Basin Proj., Spec. 2558.

Washington—Bonneville Power Admin., 729 N. E. Oregon St., Portland, Kennewick substation, Benton Co. Inv. 4553. Plans deposit $25.

Wyoming and Nebraska—Bureau Reclamation, Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, Colo., installing overhead ground wires on Cheyenne-Gering 115 kv transmission line, Spec. 2584 Kendrick Proj. between Cheyenne, Wyo., and Gering, Neb.

Low Bidders & Contracts Awarded

Fla., Jacksonville—City, Electric Power Plant 2, South Jacksonville, to George D. Auchter Co., foot of E. 56 St., **$2,488,800.** Bids 2/24, awarded 3/11; installing electrical work, in above bldg., to Cleveland Electrical Co., 557 Marietta St. N. W., Atlanta, Ga., **$244,000.** Bids 2/24, awarded 3/11.

Fla., Tampa — Tampa Electric Co., Tampa and Cass Sts., Hooker's Point Power Plant addn., to Stone & Webster Eng. Corp., 49 Federal St., Boston, Mass. Est. **$570,000.**

N. D., Grand Forks—Minnkota Power Co-operative, Grand Forks, Mar. 1, power plant addns., incl. bldg. addn. and equip. diesel plant, from Fuel Economy Eng. Co., New York Bldg., St. Paul, Minn., **$548,877.**

O., Cincinnati—The Cincinnati Gas & Electric Co., 4 and Main Sts., masonry, concrete, steel warehouse, office and service bldg., to Day & Zimmerman, Inc., Packard Bldg., Phila., Pa. Est. **$2,000,000.**

Wash., Seattle—City, County-City Bldg., Zone 4, City Light Gorge powerhouse addn. and complete penstock tunnel, to Guy F. Atkinson Co., 10 W. Orange Ave., South San Francisco, Calif., **$3,188,268.** Bids 3/2, awarded 3/9.

INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS

Proposed Construction

Ark., Little Rock—State of Arkansas, Little Rock, medical center. **$6,200,000.**

N. Y., East Meadow—Bd. Supervs. Nassau Co., Old County Courthouse, Mineola, hospital alterations, addns. $7,000,000. Plans deposit $250 general constr., $100 for others. Eggers & Higgins, 542 Fifth Ave., New York, archts.

Low Bidders & Contracts Awarded

Ill., Chicago—F. W. Woolworth Co., 211 S. State St., 100x145 ft. store and alterations, to Henry Ericsson Co., 228 N. LaSalle St., Est. **$1,650,000** and **$350,000.** Shaw Metz & Dolio, 208 S. LaSalle St., archt.

N. Y., Poughkeepsie—Bureau Contracts & Accounts, Albany, Mar. 9, General Constr., 900 bed Medical and Surgical bldg. at Hudson River State Hospital from Merritt-Chapman & Scott Corp., 17 Battery Pl., New York, **$6,538,931*****heating from Whitney Dierks Heating Corp., Poughkeepsie, **$531,300*****sanitary work from Novak & Rehner, Inc., 623 10 Ave., New York, **$519,214*****electrical from Kaplan Electric Co., 128 E. 16 St., New York, **$388,974.**

Pa., Phila.—Dpt. Property & Supplies, 18 and Herr Sts., Harrisburg, Mar. 9, general constr. Building No. N-9, Maximum Security Bldg. for male patients at Phila. (Byberry) State Hospital from Wark & Co., 1700 Sansom St., **$1,497,770.**

RECENT RATE CHANGES

STATEN ISLAND EDISON CORP, Staten Island, N. Y., will be permitted to increase its rates for electric service in the Borough of Richmond, the state Public Service Commission has announced. The commission, by a 3-to-1 vote, ordered rescinded an 8% reduction, which has been in effect since May, 1943, and gave the company an additional 5% to provide "sufficient revenue to carry on operations." The 1943 reduction and a 1945 order to the same effect have been fought in the courts, with the company continuing to bill customers at the old rate, less 8%. That phase is still in litigation. In granting the increase, to become effective with the filing of new tariff schedules, the commission reported that the company stated its need for additional revenue, "involving a substantial increase in capital outlays or expansion of plant facilities and because of increase in operating costs and taxes."

LOWELL GAS LIGHT CO's appeal to the Massachusetts Supreme Court against a rate decision of the state Department of Public Utilities has been sustained. The court found that the rate decrease granted by the board was confiscatory. The commission's order dated April 15, 1947, is therefore annulled. Return on various rate bases figured in the case would range between 3.5 and 2.5%. Income from the company's merchandising and jobbing business has not been included in the company's income for rate-making purposes. Contentions of the commission that the proceedings before a master preceding the high court hearing were subject to exceptions were thrown out. Rates must be sufficient to yield a fair return on the reasonable value of the property used or invested for doing the business after paying costs and carrying charges, the court declared.

PENNSYLVANIA POWER & LIGHT CO has filed a request with the state Public Utility Commission for permission to arrange for further application of its fuel adjustment clause for electric service to large power users in order partially to offset the company's greatly increased costs. PP&L had filed a fuel adjustment clause in February 1948, on service to customers using more than 15,000 kwhr a month and supplied under electric rates not already subject to a fuel clause. The recent filing expands last year's application to include the first 15,000 kwhr under the 12 rate schedules affected, generally described as large commercial, industrial, and resale applications. The effective date for the expanded fuel clause application is April 29, 1949.

HENDERSON (KY.) BOARD OF CITY COMMISSIONERS has increased electric power rates for manufacturers using more than 20,000 kwhr a month. Rates were raised from the present 1.5 cents per kwhr to 2 cents.

SHELBY RURAL ELECTRIC COOPERATIVE, Shelbyville, Ky., has been authorized by the state Public Service Commission to increase its electric rates $9,000 annually. Before the war the co-op's minimum bill was $3.25 for 40 kwhr. During the war that rate was changed to $1.50 for the first 15 kwhr and $1.75 for the next 25 kwhr. The recent order restores the $3.25 per 40 kwhr minimum and makes some upward changes for water-heating power.

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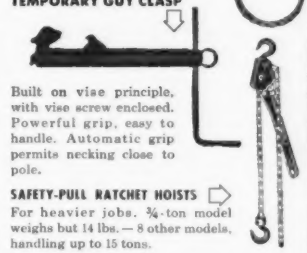

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For heavier jobs. ¾-ton model weighs but 14 lbs. — 8 other models, handling up to 15 tons.

TRANSFORMER GINS
Model OST (shown) is of malleable iron and steel construction for top of pole.

Also available: Model ST—malleable iron and steel construction for side of pole. Model WT—wood and malleable iron, a non-conductor, for pole top.

POWER PIKE POLE
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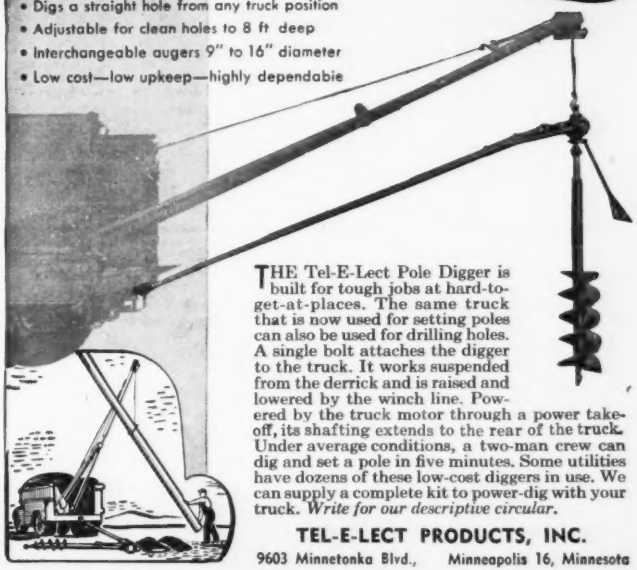

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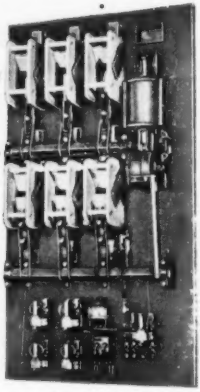

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BOOK REVIEWS

Household Electric Refrigeration. By J. F. Wostrel and J. G. Praetz. Published by McGraw-Hill Book Co, New York 18, N. Y. 458 pages, illustrated.

This second edition (first 1938) includes types of refrigerators launched in the last 10 years and, in addition to the explanation of functioning of the various systems, equipments and controls, covers the installation and servicing techniques. Diagnosis and remedial measures in specific detail continue to be a distinctive feature. An appendix identifies model numbers, refrigerant and lubrication charge, motor rating, etc for over 40 makes of units.

National Electrical Safety Code. Published by Superintendent of Documents, Washington 25, D. C. 408 pages, illustrated. Price $1.25.

This is the ASA standard sponsored by the National Bureau of Standards as Handbook H30 (superseding H3) and constitutes the fifth edition of the NESC Parts I to V are included and these embrace grounding, supply and communication lines, utilization equipment, operating rules and radio installations. Insofar as assumed conductor loading is concerned this new edition takes the wind pressure at 4 lb per sq ft for heavy and medium loading districts and the radial thickness of ice as 0.5 and 0.25 in. respectively. The change has been compensated for in the revised strength factors. This code is the rule for half the states of the nation and a sound guide for the remaining areas because it is the consensus of authoritative representatives of all affected interests.

Practical Residential Wiring. By John F. Nowak. Published by D. Van Nostrand Co, Inc. 495 pages, illustrated. Price $5.95.

The word "practical" in the title of this book describes it perfectly. It certainly tells how to do house wiring, down to the smallest detail, such, for instance, as the proper way to unfold a 6-ft rule. Assuming no previous knowledge or experience whatever on the part of the reader, the author tells how to handle conductors of the usual kinds, to read wiring diagrams and construction prints, and to lay out a wiring job. Plentifully illustrated descriptions of tools and of how to use them are included. The reader is taken through the stages of planning, preparing bills of material, roughing in, finishing and finally checking and testing various kinds of wiring installations. Intended for the home mechanic, the farmer, the wireman's helper or apprentice, the vocational school instructor and pupil, and the building superintendent, the book adheres strictly to the line of their interest.

American Electrician's Handbook. By Terrell Croft. Published by McGraw-Hill Book Co., New York 18. 1773 pages, illustrated. Price $6.

This sixth edition again conforms to the National Electrical Code (1947) and this is the authentic guide for the practical man's choice, installation, operation and upkeep of electrical circuits and equipment. One of the wholly new features is a section on electron tubes in industrial service. Other new elements are rotating regulators, synchromechanisms, rectifiers, plastic insulations, fluorescent lamps, etc.

The Roosevelt Myth. **By John T. Flynn. Published by Devin-Adair Co, 23 East 26 St, New York 10, N. Y. 438 pages. Price $3.50.**

The most impressive thing about this wholly unsympathetic and unadmiring review of Franklin D. Roosevelt's personality and his public career is the included list of 199 sources that document the author's statements. The list is impressive because its references are to books and other published material predominantly sympathetic and admiring. Each of these sources, according to Mr Flynn, "revealed some fragments of the truth. It is not until all these fragments are picked up and fitted together that we see what was going on behind the scenes." The book reveals Mr Roosevelt as lacking in sense of responsibility, as knowing no philosophy but political expediency, as unstable both in policy and in human relations, and as having no other aim than his own retention of power. The Roosevelt family and their White House gyrations also come under the author's scalpel. Altogether a most pleasing book for those whose admiration for the great man is 100% incomplete.

Transformers, Theory and Construction. By W. C. Sealey. Published by International Textbook Company, Scranton, Pa. 240 pages, illustrated. Price $3.

Selective treatment results in retention of the essential practical information about transformers and the omission of issues which are largely academic. Comparatively little effort is made to launch the technique of detailed electrical design of transformers but plenty is presented about the physical assembly and requisite performance factors. A good insight can be had into surge protection, oil protection, cooling methods, polyphase connections, tap changing, unit substations, instrument and furnace transformers and testing. The level is largely qualitative and elementary.

Kontakumformer mit Schaltdrossein. **By A. Goldstein. Published by Leeman Brothers Co, Zurich, Switzerland. 178 pages, illustrated.**

This is a mathematical design treatment of the vibrating contact type of mechanical rectifier largely developed in Europe and applied in the chemical industries where several thousand amperes at comparatively low voltage are often required. The theory embraces the use of saturable reactors to facilitate the commutation and prolong the life of the contacts. Multiphase connections are feasible as with mercury rectifiers. The USA counterpart is the equipment described in I-T-E Circuit Breaker Co Bulletin 4809 which gives comparable theory in comparable language but with much less mathematical analysis.

Vacuum Tube Amplifier. **By G. E. Valley and Henry Wallman. Published by McGraw-Hill Book Co, Inc, New York 18. 743 pages, illustrated. Price $10.**

Another in the MIT Radiation Laboratory Series (OSRD of NDRC sponsorship), this volume deals entirely with linear circuits. The amplifiers treated are designed to have extreme characteristics of bandwidth, sensitivity, constancy of gain or linearity, etc. Practical aspects of principles for determining transient response of specific networks at high (20 Mc) or low (50 C) are followed by discussions of such items as feedback, ruggedness, sensitivity, minimal-noise input. There are many circuits and design curves interspersed through the chapters.

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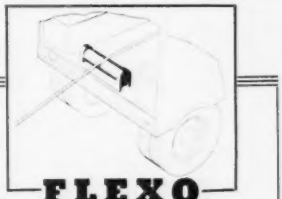

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LETTERS TO THE EDITOR

South American Utility Meets Demand

To the Editor of ELECTRICAL WORLD:

This Company here is a subsidiary of the International Power Co Ltd, of Montreal, and serves the second and third cities of Venezuela, namely, Maracaibo and Barquisimeto, of approximately 200,000 and 100,000 population, respectively.

Due to the very rapid increase in population and expansion of industry, we have had quite a problem in keeping up with the demand for electric power. We have been extremely busy increasing the capacity of our plants, transmission and distribution systems.

In Maracaibo during 1948 we installed an additional Parsons' turbogenerator of 7,500-kw capacity, together with a Foster Wheeler boiler of 150,000-lb/hr capacity. Work is in progress on a new transmission line and a system of substations in order to better serve the rapidly growing city loads. We are now in the process of extending our Maracaibo power house in order to accommodate two 15,000-kw steam turbines and also two 200,000-lb/hr boilers. The first boiler is expected late in 1949 and the first 15,000-kw turbine early in 1950.

In Barquisimeto during 1947 we installed a 1,000-kw Worthington Diesel generating unit, another similar one in 1948, and in 1949, within a few months, we are putting into service a new 1,500-kw Nordberg generating unit. An additional similar Nordberg unit will go into service early in 1950.

The total number of customers on our system at present is around 35,000. The output of our plants during 1948 was about 80 million kwhr; our estimate for 1949 is 100 million kwhr.

M. G. Taylor
General Manager
C. A. Energia Electrica de Venezuela

Welding Conference Helpful

To the Editor of ELECTRICAL WORLD:

Regarding your recent welding editorial, (Jan 29, p 88), one could not help but be impressed by the cooperative atmosphere which prevailed at the Detroit Welding Conference. As you may know our organization was among the first who attempted to obtain information from the manufacturers regarding the characteristics of resistance welders. I recall that during a trip in 1937 it was not uncommon for welder manufacturers to take the attitude that the electricity supply companies would have to supply welder loads regardless of their characteristics or the investment required. A number of utilities have been promoting the cooperative approach to the resistance welder problem and without a doubt these efforts have met with real success as evidenced by the fact that manufacturers, users, and utilities met in a conference and discussed their problems with an understanding and cooperative attitude.

It was of particular significance that many of the manufacturers now have reduced kva welder designs available for troublesome applications. These developments are very timely in view of the fact that the cost of serving such loads is predominately that of investment in utility plant.

It would appear that the AIEE Welding Conference might well be an annual affair. It is recommended that such meetings be held at least once every two years. In fact, this type of conference might well be held for other troublesome power supply problems, such as that of serving large electric arc furnaces. The writer has already suggested to AIEE Headquarters that the Institute sponsor such a conference.

E. F. Dissmeyer
Commonwealth & Southern Corp
Jackson, Michigan

Brace Structures Rugged

To the Editor of ELECTRICAL WORLD:

In one of the Technical Notes items of Dec 11, 1948 it was stated that there is a school which "favors using the inherent flexibility in the poles" in transmission lines.

In the thousands of miles of transmission line construction in this area which were subjected to the recent storms, there was not a single failure on any of the H-frames which were X-braced and properly constructed. On the contrary, time and time again so-called "gadget-free" lines left the towns without service.

There is one other point that I would appreciate clearing up and that is properly designed X-braced H-frame transmission lines can be and are being built considerably cheaper than single pole construction and are also considerably cheaper than H-frame.

Good construction cannot be confirmed until it has received the loads for which it was designed. Sometimes these run into years before these facts can actually be developed.

Ben H. Hughes, President
Hughes Brothers
Seward, Neb.

All the strength and durability inherent in steel are combined—with definite economies—in *Crapo* Galvanized Steel Strand. Heavy, ductile, tightly-bonded zinc coatings, applied by the famous *Crapo* Galvanizing Process, provide lasting protection against corrosion.

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FOR HEAVY INDUSTRIAL SERVICE
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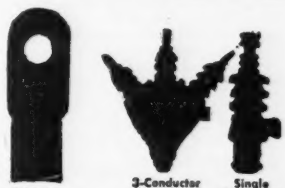

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Graduates, experienced in design, engineering and economic studies of steam-electric power plants and high voltage substations. Also, engineer experienced in power system relaying and in preparation of specifications for switchboards and switchgear. Please submit resume including personal data, education and experience record to

P 8078, Electrical World
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A man who can handle a top engineering, sales and administrative position with a well-established contracting engineering organization serving both small and large industrial and commercial firms in New York Area.
Experienced in estimating and supervising electrical construction work, as for example in industrial plant maintenance and expansion, in new building construction, or in the public utility field.
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Manufacturer of electrical transmission and distribution equipment offers exceptional opportunity to E. E. graduates under 45 with at least 4 years sales experience. Excellent starting salary. Good yearly bonus. Travel expenses. Participation in Profit Sharing Plan after 3 years. Positions are permanent and offer definite opportunity for advancement. Submit full particulars.

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For Positions of
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Steam Power Plant and or Gas Plant Experience Preferred. Ideal Community—Close to Metropolitan Areas. Write to
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PENNSYLVANIA POWER & LIGHT CO.
Allentown, Pa.

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Experienced in design of electric switchgear and protective equipment by national manufacturer in small Midwest city. Give full details.

P-8315, Electrical World
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REPLIES (Box No.): Address to office nearest you
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CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

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WANTED: MANAGER for $6,000,000.00 Michigan Power Generation and Transmission Cooperative System, financed by the Rural Electrification Administration. Engineering or utility experience desirable but executive competence primary requisite. Write for application blanks. Wolverine Electric Cooperative, c/o Earl C. Murley, Newaygo, Michigan

WANTED, SEVERAL engineering graduates, under 35, by large industrial fire prevention organization maintained by leading insurance group. Permanent position. Periodic inspections and special consulting service for leading industrial plants. Thorough training. P-8066, Electrical World.

ENGINEERS: LARGE college offers $3000, approx. half time teaching-studying. All ranks univ. positions, experienced $4500-$6000 months. Give phone, photo, qualifications, Cline Teachers Agency, East Lansing, Mich.

EXPERIENCED SUPERVISOR for motor rewinding and repair shop, serving large industrial area. P-8331, Electrical World.

EMPLOYMENT SERVICES

SALARIED POSITIONS $3,500-$35,000. If you are considering a new connection communicate with the undersigned. We offer the original personal employment service (39 years recognized standing and reputation). The procedure is highest ethical standards, is individualized to your personal requirements and develops overtures without initiative on your part. Your identity covered and present positions protected. Send only name and address for details. R. W. Bixby, Inc., 262 Dun Bldg., Buffalo 2, N. Y.

SALARIED PERSONNEL $3,000-$25,000. This confidential service, established 1927 is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Ira Thayer Jennings, Dept. L, 241 Orange St., New Haven, Conn.

POSITIONS WANTED

ELECTRICAL ENGINEER, age 43, excellent health, wide experience in testing, inspecting, design and construction of power plants, industrial plants, substations, switch boards, automatic controls, power and lighting distribution and Hi-tension relaying. PW-8151, Electrical World.

ELECTRICAL ENGINEER. Age 52, experienced in the layout and designing of power plants, sub-stations, automatic controls, industrial plants and equipments, power, lighting, and distribution. PW-8363, Electrical World.

EXECUTIVE ELECTRICAL engineer, age 35, with extensive experience with major electrical manufacturer in design and application of large apparatus plus broad experience with electric utility company in generation, transmission and distribution planning and engineering, plus intensive training in business desires responsible administrative or executive position with utility company. Midwest or western location preferred. PW-8355, Electrical World.

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EXECUTIVE-ENGINEER type of creditable sales representation in Tennessee, Mississippi, Arkansas. Headquarters Memphis. Write RA-8325, Electrical World.

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Development Engineer

Having wide experience in Electrical Control and Resister Design, also Self-priming Centrifugal Pump Design. Give details of education, experience and salary desired.

GUYAN MACHINERY CO.
Logan, West Va.

ELECTRICAL DISTRIBUTION ENGINEER

. . . with five or more years experience.
Please give full details in first letter

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1—450 HP.—Ridgeway 900 rpm 2200v.
1—125 HP. G.E., 1800 rpm 2300v.
1—100 HP. Whse, 1800 rpm 440v.
1—100 HP. Whse, 1200 rpm 2200-440v.
1— 75 HP. Whse, CS, 1200 rpm, 2200 volts, 3 phase, 60 cycle.
1—75 HP. 1800 rpm Westinghouse, 440 volt.
1—75 HP. General Electric Type KT 900 RPM 440 volt.
2—40 HP. G.E., 900 rpm 220v.

MOTORS SLIP RING

1—2500 HP G.E. MT 257 RPM 6600 volt.
2— 150 HP G.E. Type IM 450 RPM 440 volt.
1— 100 HP G.E. Type IM 400 RPM 440 volt.
1— 100 HP G.E. 720 rpm 440v, 25 cy. IM.
75 HP. G.E. 1200 rpm 220v, 60 cy. Vert.
60 HP. West. 900 rpm 220v, 60 cy. Vert.
50 HP. F.&M. 1800 rpm 220v, 60 cy.

MOTORS—D. C. 230 VOLTS

1—125 HP. G.E. 1800 rpm R.C.
1— 75 HP. 865 rpm General Electric
1— 50 HP. 700 rpm Crocker-Wheeler

VARIABLE SPEED—220 VOLTS

1—35 HP. 300/1200 rpm Westinghouse.
1—50 HP. 440/1200 rpm General Electric.
2—25 HP. 650/2200 rpm Westinghouse.
2— 25 HP. 300/900 rpm Electric Dynamic.
1—35 HP. 500/1500 rpm General Electric.

MOTOR GEN. SETS

1—1000 KW Westinghouse 275 volt, 720 RPM 4000 volt Syn.
1—1000 KW General Electric 600 volt 514 RPM 4000 Volt Syn.
1—500 KW. G.E. 250v 900 rpm 2300v Syn.
1—500 KW. G.E. 575v 900 rpm 2300v Syn.
1—125 KW. Crocker Wheeler 1200 rpm 125v Generator 2200v S.C. Motor.
1—100 KW. Elect. Mach. 1200 rpm 125v Generator 4150 Syn. Motor.

PLATING GENERATORS

1—1½ KW. G.E. 5-6v with sq. cage int.
1—12 KW. Hansen Van Winkle 24v 1200 rpm. 20 HP. General Electric KF Motor.
1—3000 Amp. Chandeessson, 6/12v 400 rpm Syn. Motor.
1—2500 Amp. ditto.
1—625 KVA West. Reduction Gear Turbo Generator Non-Condensing, 2400v 3 ph 60 cy.

TRANSFORMERS

1—1000 KVA G.E. 3 ph. 4150 volt to 2400 volt.
3—300 KVA Pitts. 2300v pri. 115/230v sec.
3—300 KVA G.E. type H 2300v pri. 115 230v sec.
3—150 KVA West. 2300 volt Pri. 240/480 sec.
1—150 KVA G.E. 2300v 110-220v.
3—75 KVA American 2400 volt primary 240/480 secondary.
10—27½ KVA G.E. 1 ph. brand new 440/220v 220-110v.

ALTERNATORS & SYNCH. MOTORS

1—2500 KVA Westinghouse, Syn. condenser, 720 rpm 2200v with D.C. exciter.
1—320 KVA Allis Chalmers, 450 rpm 480v.
1—240 KVA General Electric ATB, 600 rpm 240v with D.C. exciter.
1—225 KVA 514 rpm 600v Westinghouse.
4—200/100 HP. Whse. 720/360 rpm 4150v
1—200 HP General Electric 257 RPM 440 volt.
1—165 KW. 514 rpm 2200v Electric Machinery.
1—100 HP. G.E. type TS 600 rpm 4400v D.C.
2—150 HP. Allis Chalmers, 360 RPM, 2200 volt

Complete Line of A.C. and D.C. Motors and Generators

WANTED

Hard Hitting Sales Engineer to obtain new business for Concern located in Eastern Penna. Established since Year 1909, engaged in Electric Motor Rebuilding. Facility equipment of the best obtainable. Must have thorough knowledge of principles governing subject of Electric Motor Winding Construction. Also will be required to have automobile for use in traveling. Prefer man accustomed to earning $10,000 per year with customer following already acquired. Apply to

P-8427, Electrical World
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500 KVA TRANSFORMERS

3—Transformers, 500 KVA, 1 phase, 60 cycles substractive polarity, 2300 H.T. volts, 460 volts L.T., Type ODSC, Gals. oil 407, Spec. 9649B, Temperature rise 55 c, Impedance at 75 degree C 4.1%, Serial #714538, 39, 40. Allis-Chalmers Mfg. Co., Pittsburgh Transformer works, Pittsburgh, Pa., U.S.A. Excellent condition.

FS-8311, Electrical World
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FOR SALE

Three (3) Winton Diesel Engines

complete with generators, alternators, pumps, etc. Complete description of units upon request.

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CITY COORDINATOR,
CITY OF TIPTON, INDIANA

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TRANSFORMERS
FOR SALE

20—1½ KVA G-E 120/240/480—120/240 DRY
40—10 KVA A-Ch 450/225—117/234 DRY
10—10 KVA A-Ch 460/230—230/115 DRY
20—15 KVA A-Ch 450/225—117/234 DRY
9—15 KVA A-Ch 460/230—230/115 DRY
15—20 KVA W-H 450/225—117/234 DRY
12—20 KVA W-H 460/230—230/115 DRY
6—25 KVA W-H 450/225—117/234 DRY
6—26 KVA W-H 460/230—230/115 DRY
3—75 KVA W-H 230/460—115/230 DRY
6—25 KVA W-H 13200—120/240
9—37½ KVA W-H 13200—120/240
3—50 KVA Pitts 26400—2300/4000Y
3—50 KVA G-E 33000—2400/4160Y
3—150 KVA G-E 2300/4000Y—115/230
3—200 KVA W-H 6600/11430Y—2300
3—333 KVA G-E 13800—120/240
1—Gas Fired Recirculating Youngs Bros. DRYING OVEN, 2 Compts., complete with controls.

TRANSFORMERS WANTED

Rewind and repair services on all makes of transformers. One year Guarantee.

THE ELECTRIC SERVICE CO.
Cincinnati 27, Ohio

Your inquiry will have special value . . .

if you mention this magazine, when writing advertisers. Naturally, the publisher will appreciate it . . . but, more important, it will identify you as one of the men the advertiser wants to reach with this message . . . and help to make possible enlarged future service to you as a reader.

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Deaerating boiler feed-water heater, 50,000 to 100,000 pounds capacity.

Water softening and demineralizing equipment, metal-clad switch gear, 19000/2300 V power transformers.

ROOM 4200
141 W. Jackson Blvd., Chicago, Ill.

WANTED

Used GE or Westinghouse three or six element magnetic oscillograph with film attachments

W-8303, Electrical World
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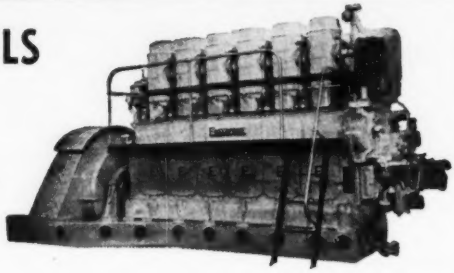
WITH 300 KW IDEAL A.C. GENERATORS

FOR

IMMEDIATE DELIVERY



OTHER DIESELS AVAILABLE
UNIT CAPACITIES—10 TO 1420 KVA
A.C.—50 AND 60 CYCLES

A PARTIAL LIST OF OUR INVENTORY

KVA	Make	Model	HP	RPM	KVA	Make	Model	HP	RPM
1420	Fairbanks Morse	38D8⅛	1600	720	312	General Motors	8-268A	450	1200
1250	General Motors	16-278A	1600	720	300	Fairbanks Morse	YVA	360	257
900	General Motors	12-567	1080	720	200	Buckeye	80	240	600
625	Superior	OS	750	327	125	General Motors	3-268A	150	1200
425	Baldwin	VO-6	510	450	75	General Motors	6016-E	90	1200
375	Enterprise	DSG-6	450	450	62	Int'l Harvester	UD-18	76	1200

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A. G. SCHOONMAKER Company, Inc.

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TURBO GENERATORS

Item #	Quantity & Capacity	
1049	2000 KW	175# 486° ISP. 2400 volt. CONDENSING. All auxiliaries. 1918. Entirely overhauled and rebuilt 1940. In all critical and moving parts it shows 5 years' normal wear. Heavy 3rd stage wheel installed. Total log record 8 years.
1887	3000 KW	200# 486° ISP. 2400 volt. CONDENSING. All auxiliaries. 1919.
601	2500 KW	250# 550° ISP. 2400 volt. EXTRACTION: 90,000#/hr. Max. @ 15#G. Built 1927. Good condition. Some spare blading.
602	2500 KW	250# 450° ISP. 2400 volt. CONDENSING. All auxiliaries. 1934.
1475	4000 KW	600# 750° ISP. 13.8 KV. MAX. THROTTLE FLOW: 95,000#/hr. AUTOMATIC CONTROLLED EXTRACTION: 45,000#/hr. @ 135#G. (Can modify 125# to 150#) and BACK PRESSURE @ 20#G. (Can modify 15# to 25#). Minimum to exhaust @ max. extraction: 2000#/hr. Complete except switchgear. New—never installed — immediate delivery.

BOILERS

1864	700 HP	450# 600° FTT. C.E. Co. Chain grate, stoker fired. All controls. 60,000#/hr. each.

TRANSFORMERS 1Φ

794	2000 KVA (3)	27 KV Primary. 2300 and 480. Rated 1500 KVA at 2300 and 5000 KVA @ 480.
1814	2000 KVA (2)	23 KV (4-2½% taps above and below) Primary. 2300 Secondary. Less than one year service.

TRANSFORMERS 3Φ

1856	2500 KVA	13.2 KV Primary. 6.6 KV Secondary (with two 10% taps below).
669	2000 KVA (7)	11.5 KV Primary. 480 V Secondary. Pyranol filled.
1515	7500 KVA (5)	33 KV Zig-Zag Primary. 13.8 KV Secondary (Reconnectable to 6.9 KV).

FURNACE TRANSFORMERS

345	4000 KVA	(3Δ) 24 KV (with 2-10% taps below) Primary. 228/92 (in 12 steps) Secondary. Transformer 5%, Reactor 50% Reactance. Built 1942. Used 2 years.
1521	3000 KVA (6)	(1Δ) 13.2 KV Primary. 240/160 (6 taps) Secondary.
666	8000 KVA (3)	(3Δ) 11 KV Primary. 100/160 Secondary.
673	1000 KVA	(3Δ) 7.2 KV (with 1-10% tap above and 2 below) Primary. 214/125/94 Secondary. 1934.
604	1200 KVA	(3Δ) 12 KV Primary. 190/87 (8 taps) Secondary. 1931.
350	200 KVA	(3Δ) 230 V. Primary. 120/60 Secondary. New.

MOTOR GENERATOR SETS

641	300 KW	250 volt D.C. 2400 volt A.C. 1200 RPM. Rebuilt & Guaranteed.
1415	300 KW	250 volt D.C. 480 volt A.C. 1200 RPM. Rebuilt & Guaranteed.

ROTARIES

801	1500 KVA (2)	275 volt D.C. 13.8 KV A.C.
816	2925/3705	222/285 volt D.C. 13.8 KV A.C. Synchronous booster.

PAUL STEWART

UNION TRUST BUILDING

MAin 5873
MAin 3427
CINCINNATI, 2, OHIO

TURBO GENERATORS

TURBINE OF THE MONTH

1—750 KW-GE 250 lbs. cond., 3 ph. 60 cy. 40, direct conn. Exciter, Surface Condenser. Built 1944.

1—5000 KW 6250 KVA, G.E. 3600 RPM 175/200 lbs. I.SP. 100° S.H. Condensing 3 ph. 60 cy 2300/4000v. Surface Cond. & Aux.
1—2000 KW G.E. 6600c, 3 ph., 60 cy. with 175 lb. cond. turbine and dir conn. exciter
1—1500 KW G.E. 2300v, 3 ph., 60 cy. with G.E. 225 lbs cond turbine, surface condenser
2—1250 KW GE. 2300v, 3 ph., 60 cy. with 175 lbs. condensing turbine
1—1250 KW Al Ch. 2300v, 3 ph., 60 cy. with 200 lb. condensing turbine, surface condenser
1—1000 KW G.E. 2300/4150v, 3 ph., 60 cy. with 135/150 lb. condensing turbine

BELYEA COMPANY INC.
51 Howell St. Jersey City 6, N. J.
Phone—Journal Square 2-3334
ALSO N. Y. CITY LINE—RECTOR 2-7150

FOR SALE

One 1,000 KW G.E. turbo unit incl. condenser, auxiliaries, foundation plans—being replaced by larger unit.
750 KW Whse. turbo unit
Two 2000 gpm motor-driven pumps
10,000 #/hr. Deaerating Heater

ROOM 4200, 141 W. JACKSON BLVD.
CHICAGO, ILLINOIS

New and Used Equipment Available for
POWER PLANTS, SUBSTATIONS, TRANSMISSION LINES AND CONSTRUCTION
Send for new list to
EBASCO SERVICES INCORPORATED
APPARATUS EXCHANGE 120 Wall St., New York 5, N. Y.

MOTORS, GENERATORS, TRANSFORMERS
1 — 1500 H.P.
Bought and Sold
New and Rebuilt
ELECTRIC EQUIPMENT CO.
ROCHESTER 1, N. Y.

"SUCCESSFUL OPERATION GUARANTEED" Belyea

We Rebuild in accordance with N.I.S.A. Standards

D. C. MOTORS

Qu.	HP	Make	Type	Volts	Speed
1	1750	Whse.		600	550/700
6	1500	Whse.		525	600
1	1200	Whse.		600	525/700
1	700	G.E.	MCF	600	150/825
1	600	G.E.	MPC	250	115/145
1	600	Whse.		600	800/950
2	600	G.E.	MPC	600	600/720
1	385	Whse.	MQ	250	300/900
1	200/300	G.E.	MPC	220	360/920
1	275	Whse.	QM-600.6	230	425/850
1	250	G.E.	MPC	230	400/800
1	230	Al. Ch.		230	700
2	150	Whse.	SK-200	230	600
1	150	Cr. Wh.	CMC-65H	230	1150
1	150	G.E.	MPC	230	230/450
1	150	Cr. Wh.	152HL	230	300/1050
3	150	Cr. Wh.	TEFC-87H	230	S90
1	150	G.E.	CD-B-Brg.	600	250/750
1	125	G.E.	CV	230	625
1	125	El. Dy.	308	230	750/1500
1	115	Cr. Wh.	JHL	230	1200
1	100	G.E.	CD-175	230	365/730
1	100	G.E.	MPC	230	225/450
3	100	Whse.	SK-Vert.	230	485/950
2	100	Rel.	1050T	230	400/1200
1	80	El. Dy.	308	230	475/950
2	75	Cr. Wh.	53H-TEFC	230	860
1	75	Whse.	SK-180	125	650
1	75	G.E.	Sprague C	230	500/1000
2	75	G.E.	CDM-1126Y	230	2000

TURBO GENERATOR SETS

See ad on page 156

SYNCHRONOUS CONDENSERS

Qu	KVA	Make	Type	Volts	Speed
1	5140	Whse.		4150	600
1	4000	G.E.	TSC	2400/4150	900
1	3000	Whse.		2400	720
	3000	G.E.	ATI	4800	720

MOTOR GENERATOR SETS
3 Ph. 60 Cycle

Qu.	KW	Make	Speed	DC Volts	AC Volts
1	1800	G.E.	600	125/250	4000
1	1500	G.E.	360	275	2200/4400
1	1500	G.E.	600	600	4150
1	1500	Whse.	600	600	4150
1	1250	G.E.	600	275	2300/4150
1	1000	Cr. Wh.	720	250	2300/4150
1	1000	Whse.	514	250	4000
1	1000	Whse.	514	600	4000
1	800	SUGE	1200	240	2300
1	500	G.E.	720	125	2300/4150
1	500	G.E.	720	600	4400
1	400	(3U)CrWh	1200	125/250	440/2300
1	400	G.E.	720	250	440/2300
1	400	G.E.	1200	120/240	440
1	300	G.E.	900	125	4150
1	300	G.E.	1200	120/240	440
1	250	Whse.	1200	240	440
1	150	Cr. Wh.	1200	250	220/440
1	100	G.E.	1170	125	220/440
1	100	G.E.	1200	250	2200

ROTARY CONVERTERS (60 cycle)

Qu.	KW	Make	Speed	DC Volts	AC Volts
1	2000	G.E.	514	600	13200
1	2000	G.E.	450	600	13200
1	1000	Whse.	900	600	11000
1	750	Whse.	900	600	13200
1	500	Whse.	900	250	6600

All units can be furnished with AC and DC Control

MERCURY ARC RECTIFIERS

1	1000	Al. Chal.	B-612	625		13500
*1	1000	B-B	25/60	625	6600/13200	
1	750	G.E.	RHW	575	2300/4000	

*Complete with full automatic A.C. and D.C. controls.

A. C. MOTORS—3 Ph. 60 Cycle

Synchronous

Qu.	HP	Make	Type	Volts	Speed
2	3500	G.E.	TS	2300	257
2	2100	G.E.	ATI	4600	514
2	2000	Whse.		2200	120
1	1470	Whse.		2300/4600	900
1	1000	Whse.	MILL	2300	189.5
2	900	Al. Ch.	Eng. (new)	2200	150
1	600	Whse.		440	360
1	500	G.E.	ATI	480	900
2	500	G.E.	TS-9832	4160	600
1	450	Whse.		2200	128.5
2	350	G.E.	TS	2200	150
1	320	G.E.	ATI	2300	600
1	308	Al. Ch.		440	600
1	300	G.E.	ATI	440	720
1	300	Whse.	Enc.	2300	720

Slip Ring

1	1000	Whse.	CW	2300	705
2	700	Whse.	CW	2200	900
1	500	G.E.	IP	550	505
2	450	G.E.	IM	440	505
1	500	G.E.	MIB-IM	2300	450
1	400	G.E.	IM	2200	252
3	350	Whse.	CW	2200	900
1	350	G.E.	MT-442y	4000/2300	257
1	300	Al. Ch.	ANY	2300	505
1	250	G.E.	MT	4000	257
1	250	G.E.	MT-5598	2200	750
1	135	G.E.	IM	2300	700
2	100	G.E.	IM-16	2200	435

Squirrel Cage

1	250	G.E.	KT-559	440	1750
1	200	G.E.	KT-557	440	1800
1	200	G.E.	IK	550	855
1	150/50	Whse.	CS	440	879/343
1	125	(new) G.E.	KF TEFC	440	1190
1	125	G.E.	KF-6328L	440	3558
2	100	G.E.	KT-543	220/440	1750
1	100	G.E.	IK	440	575

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1⅛" I.D. x 1 7/16" O.D.	.25 per foot
5/16" I.D. x ½" O.D.	.08 per foot
¼" I.D. x ½" O.D.	.08 per foot
3/16" I.D. x 9/16" O.D.	.08 per foot

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2— 620 KW—240 VOLT—DC GENERAL ELECTRIC GENERATORS DIRECT CONNECTED TO ALCO TYPE 6—12½ X 13-T 900 HP—700 RPM DIESEL ENGINES.

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Start by analyzing your present system . . .

. . . to determine where you require, or will in the future require, additional current-carrying and interrupting capacities.

then, call in the I-T-E switchgear specialist*. . .

. . . who will prepare, right at your desk, a one-line diagram and an outline sketch of your electrical and space requirements.

he'll give you "on the spot" estimates and recommendations...

. . . on the required number, the types, and the ratings of breakers, instruments, bus, and other components; as well as specifications for enclosures and the arrangement of units.

next, you just check the finished drawings and proposals . . .

. . . that I-T-E prepares from your suggestions. These recommendations include one-line diagrams of the proposed system, an outline arrangement of units with dimensions, construction details, price and delivery quotations.

indicate any desired revisions . . .

. . . that you wish made in the proposed construction; place the order—

and connect up the assembled unit!

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High voltage side of a 1250 KVA power transformer, primary 66,000, low 12,700/22,000, 60-cycle single phase, with door cut away to show inert gas equipment.

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QUESTION:

A dry type Class B insulated transformer rated 100 Kva, 4800-120/240 volts, 60 cycles, single phase is to be connected to a 4600 volt line. What are the estimated losses and performance at 4600 volt operation for the same Kva rating? Losses at 4800 volts are given below.

ANSWER:

	4800 volts	4600 volts	% Change @ 4600 volts
Primary Voltage			
Secondary Voltage	120/240	115/230	
Core Loss	595 watts	543 watts	— 9%
Copper Loss (75°C)	1045 watts	1094 watts	+ 5%
Primary current at Full Load	20.8 amperes	21.75 amperes	+ 4%
% Impedance	3.5%	3.91%	+11.2%
Regulation			
100% P.F.	1.10%	1.17%	+ .06%
80% P.F.	2.93%	3.18%	+ .09%
Efficiency			
Full Load	98.4%	98.4%	
¾ Load	98.45%	98.5%	
½ Load	98.30%	98.4%	
¼ Load	97.40%	97.6%	

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